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OUR 62nd YEAR

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APRIL, 1951

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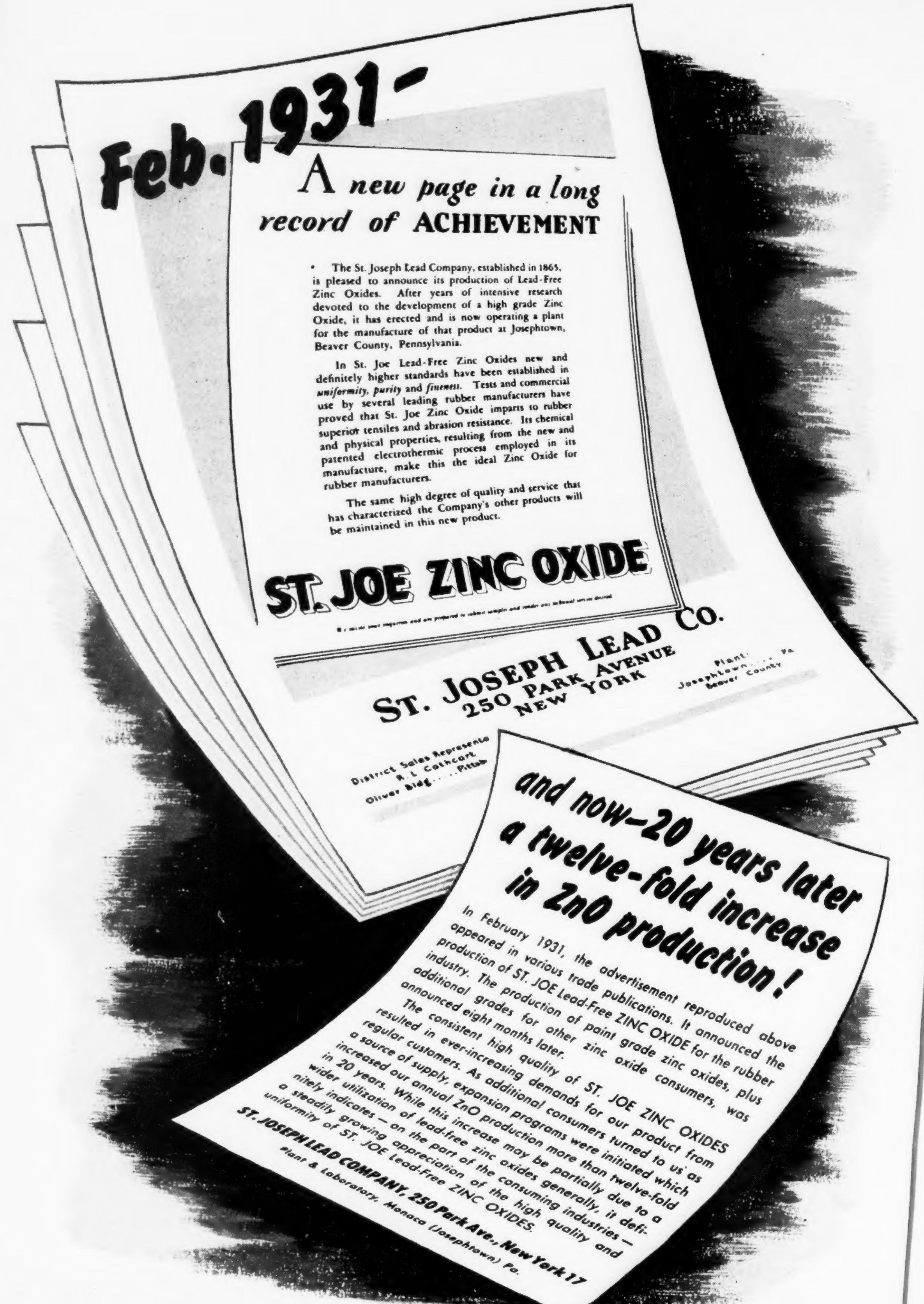
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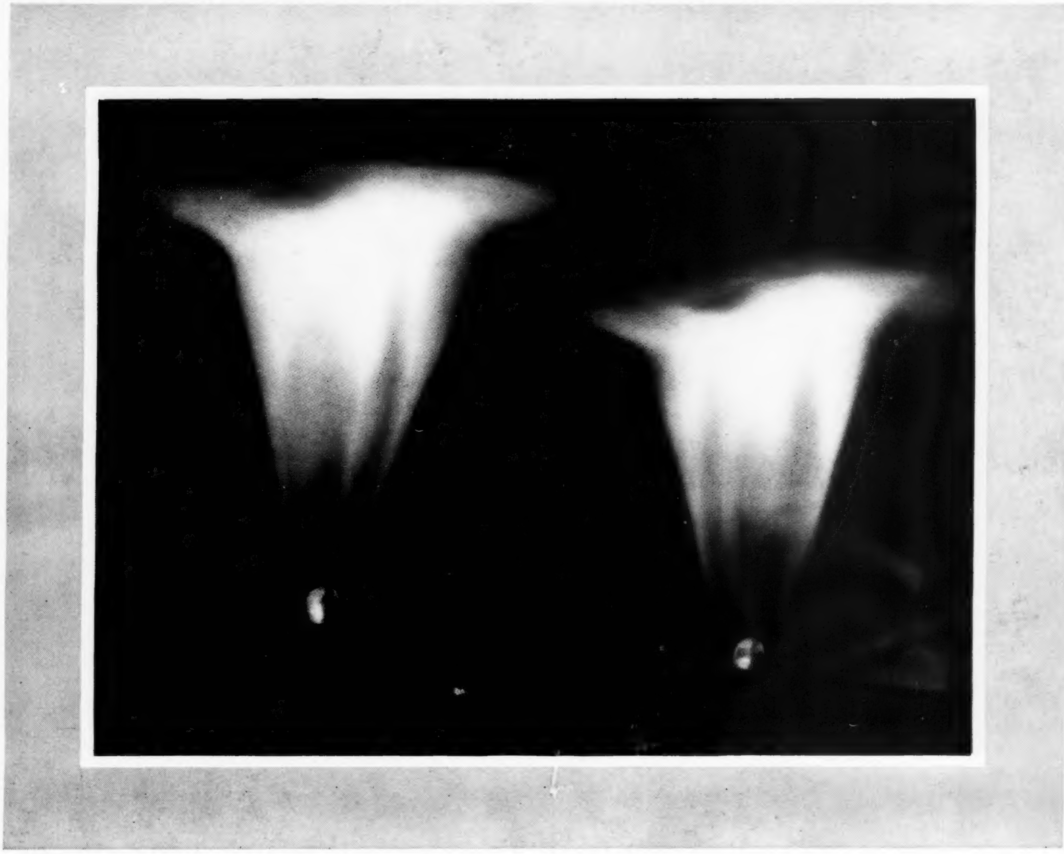

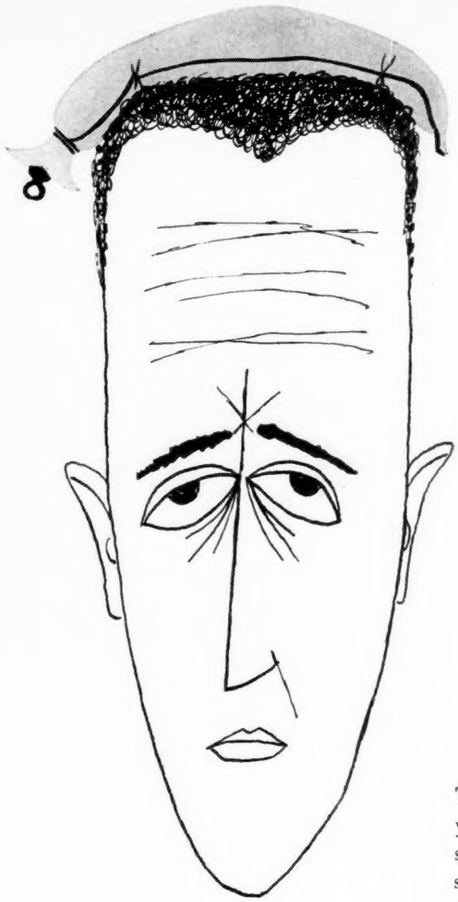

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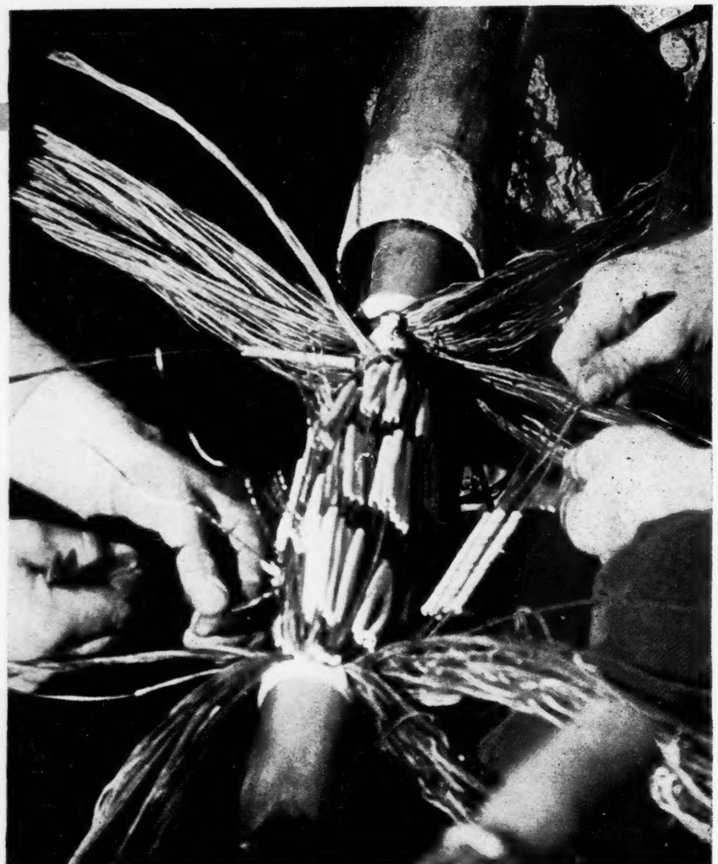

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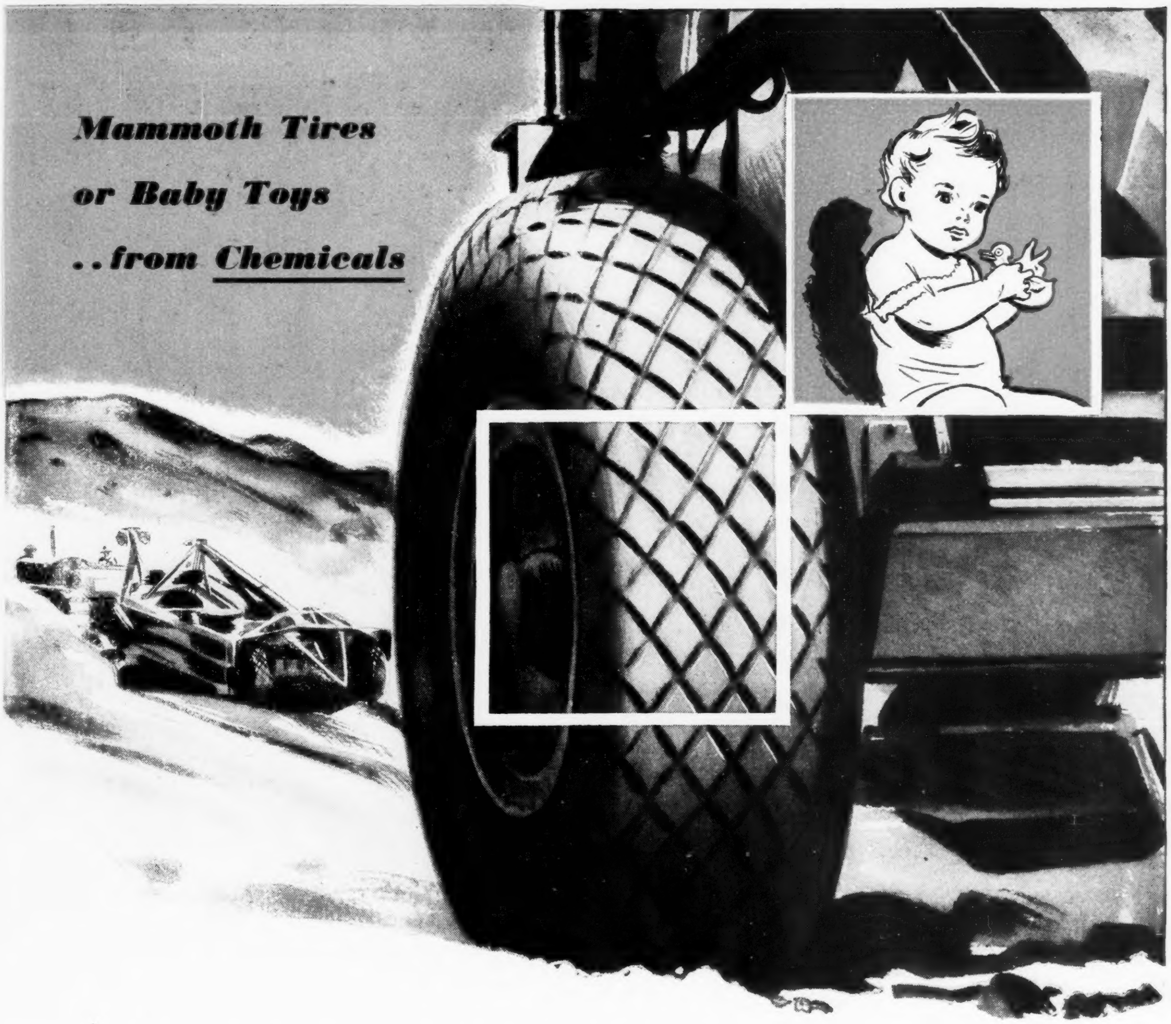

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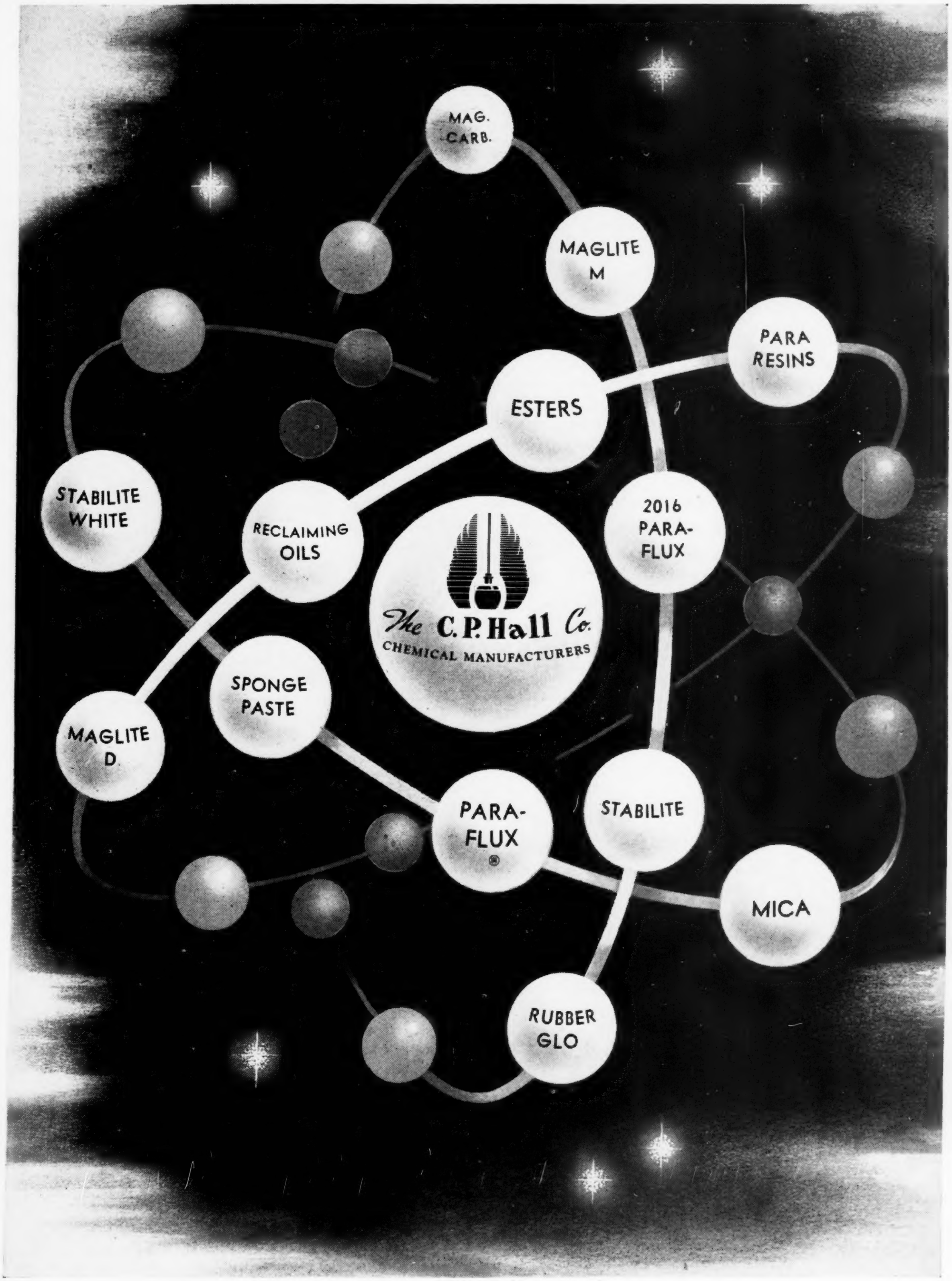
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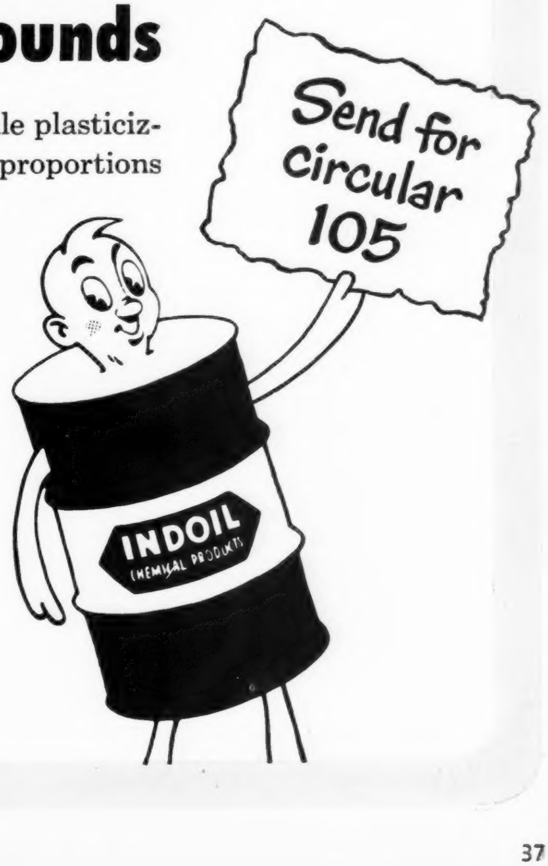

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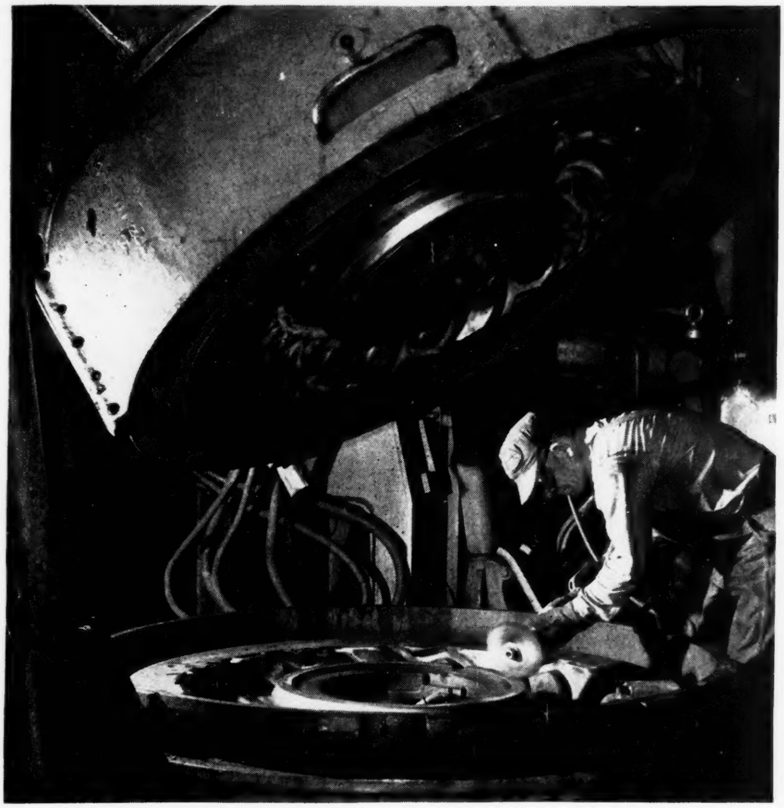

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INDIA

RUBBER WORLD

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APRIL, 1951

Vol. 124—No. 1

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INDIA
RUBBER
WORLD

VOL. 124 — NO. 1 APRIL, 1951

The Rate of Cure of Present-Day Whole-Tire Reclaimed Rubber[1]

J. M. Ball[2] and R. L. Randall[2]

RECLAIMED rubber vulcanizes faster than new rubber when comparable compounds are used. Shepard, Kilbourne, and coworkers (1-2)[3] pioneered on this subject more than 20 years ago, finding that both alkali process and non-alkali (water cook) process reclaims sped the cure appreciably when they were incorporated into natural rubber. By extraction and addition of alkali Kilbourne accounted for the accelerating action of the alkali process reclaim, but he was not able to account for the behavior of the neutral reclaim. About 10 years ago Palmer and Crossley (3) reached somewhat comparable conclusions by means of the T-50 test.

The possible influence of the combined sulfur in the reclaim was discussed and rejected by these workers, but just a few years ago Ira Williams (4) in his Goodyear medal lecture threw additional light on this matter. From his experiments with smoked sheet he concluded:

"The presence of combined sulfur is sufficient to cause an increase in the rate of combination of sulfur."

Reclaimed rubber, of course, always contains combined sulfur and might therefore be expected to hasten cure. The authors of the present paper are content with this suggested explanation, at least as a working hypothesis.

Definitions and Criteria

Rate of cure may be defined simply as the rate of change of physical properties with time of cure. It changes constantly with time of cure, and it is different for different properties. It is usually expressed as the time required to reach a predetermined *state* of cure, i.e., as Whitby (5) points out by giving the inverse of the rate. Whitby (6) defines state of cure as "the position of a cure in a series of progressive cures."

The subject of rate of cure is vital to the factory compounder who must know when he has made a properly cured piece of rubber, and how long it takes to make it. The quality of the cure, furthermore, must be good. Some compounds never do cure satisfactorily.

As the late C. W. Bedford once said to one of the present authors when Bedford was exhibiting some sticky, lifeless slabs of rubber containing an experimental non-sulfur vulcanizing agent: "They're vulcanized, but they're not cured."

It may be worthwhile here to review briefly some of the excellent work of the past which has been designed to establish suitable criteria for judging rate of cure.

Old-time rubber men still rely on a hand test, sometimes called the "bite and tear" test. At the request of the authors H. A. Braendle[4] has kindly submitted a memorandum on this subject, which follows:

"We define the best cure as that chosen by hand test and representing the earliest cure of reasonable snap with substantially unimpaired tear. Our actual procedure, whether with GR-S or any other rubber, is to cut slivers about ⅛" wide and about 2" long from the side of a standard press cured sheet, leaving one end attached to the parent sheet. With this as a grip the sliver is then stretched to the tight point about a dozen times in rapid succession. The degree and recovery of subpermanent set is then observed visibly. The specimen is then again stretched to the tight point, when such qualities as flow or creep at this tight point, the ability or force with which the specimen fights back and the rate at which the stretched rubber pulls back on release are integrated as measures of snap. By this means the logy undercures are eliminated. In the case of GR-S rubbers particularly, this cure, namely the earliest of good snap, is finally determined by comparing it against the loss of hand tear as cure progresses.

"Where a reasonably close selection, namely, within 5 minutes of an optimum cure, is not possible, a 2" x 6" strip of the stock is rolled up tightly and released, whereupon the rate of snap and the final creep are evaluated. This, of course, involves the presence of a control stock of known curing characteristics, or is of

---

[1] Presented before the Division of Rubber Chemistry, A. C. S., Washington, D. C., March 1, 1951.
[2] Midwest Rubber Reclaiming Co., East St. Louis, Ill.
[3] Numbers in parenthesis refer to Bibliography items at end of this article.
[4] With Columbian Carbon Co., New York, N. Y.

value in comparing two stocks in which it is a bit difficult to evaluate fine differences in snap. Another expedient is to fold over the press cured sheet, pinch it tightly with the fingers at the fold, and then release it suddenly, watching to see how rapidly the crease mark disappears.

"Hand tear is usually estimated as an average of at least a dozen tears starting with about a 1" cut into the sheet. In the case of some pigments, particularly those with an acicular habit, it is frequently necessary to do a hand tear in the plane of the sheet; in other words cut a 1/8" or 1/4" strip in the conventional way and then start a cut in the plane of the sheet somewhere midway between the two faces to see whether there has been any layering.

"Another hand test that I have seen used by old-time experts, such as the late D. F. Cranor, is to take a sliver or strip of rubber, stretch it tight between the hands, and then pluck it like a violin string to see whether under constant pull the note it emits maintains or loses its pitch as the rubber sags and flows. I'll admit that not too many people have mastered this technique, but when Donny was still with us I was always prepared to back his cure selection based on it."

Whitby (7) was one of the first to emphasize the value of the stress-strain curve as compared with tensile data alone as "a precise index" to the state of cure. Of course he was referring to rubber-sulfur stocks only.

Whitby's criterion has stood up through the years. Carpenter (8), for example, wrote:

"The usual method of examining the rate of vulcanization of a compound is to determine the stress-strain relations, including the ultimate values, for a series of test sheets vulcanized for a range of periods at one temperature."

He continued: "The tensile strength of a rapidly vulcanizing compound rises quickly and often has a relatively narrow plateau, depending on the concentration of sulfur and the intensity of acceleration. Frequently, with technical mixings, the modulus increases at a slower rate during vulcanization, and reaches its maximum value later than is true for the breaking strength, which indicates that in progressive vulcanization the compound would attain its maximum strength before developing its maximum stiffness. This introduces one of the complications in the selection of the best state of vulcanization of the compound. Should the choice be the state and temperature corresponding to the maximum tensile strength, or should the maximum tensile-stress values also be taken into consideration? In practice, other properties such as aging, cannot be ignored."

Wiegand (9) defined optimum cure as "that cure at which some numerically measurable property of the rubber, which may be agreed upon as the most suitable, reaches a fixed point, preferably its mathematical maximum." He discussed coefficient of vulcanization, elongation at rupture, tensile strength at rupture, modulus, tensile product, and energy of resilience. He advocated the use of the mathematical maximum of tensile product as the criterion for judging optimum cure.

Somerville and Cope (10) explained their method for selecting a proper cure. They plotted tensile strength against time of cure, being sure to include both an undercure and an overcure. The proper cure they considered to be the one just below that corresponding to the maximum tensile. If the curve is fairly flat so that "it is difficult to pick one proper cure, then three cures have been picked . . . and the average results obtained on the three cures used in calculating stress-strain relations. . . ."

The early workers on the rate of cure of reclaimed rubber (1928 and 1930) arbitrarily chose "to use the peak in the curve in which time of cure is plotted against stress at a given elongation as the point of reference in comparing rates of cure." (1).

Palmer and Crossley (3) used the T-50 test satisfactorily, but their work was done before the advent of GR-S.

Sperberg (11) and coworkers for the past several years have been studying relaxed compression set in relation to state of cure. This test, according to Sperberg, is a direct measure of state of cure of soft rubber compounds.

It is derived from Ira Williams' definition of vulcanization (12): "In the broadest sense vulcanization to produce soft rubber is any treatment which maintains the elasticity of the rubber while its plasticity is decreased."

The test is based on the physical change in plasticity which accompanies vulcanization. The details of the test are given later in this paper.

Dunlap, Glaser, and Nellen (13) observe hysteresis loops made at low stress by the inclined plane tester to measure rate of cure. This method had not been fully developed when the work described in the present paper was being done.

Roth and Stiehler (14) obtain elongation at constant load on the strain tester developed by the National Bureau of Standards as a result of intensive work by them since 1944. Their object has been to minimize testing errors. If elongation at constant load is plotted against time of cure, the curve corresponds to a rectangular hyperbola which can be characterized by three constants, designated as vulcanization perameters: scorch time (t_o), structural rigidity ($E\infty$), and rate of cure (k).

Schade (15) extended the work of Roth and Stiehler by presenting a method for determining the "preferred" time of cure from the parameters t_o and k calculated from the strain data. This method is not an absolute one, but is relative. That is, it involves the assumption of a reference point for a control compound. That reference point is an assumed preferred time of cure established by some other method. From it the preferred times for other compounds being compared can be calculated.

It cannot be denied that this method of strain testing, offering as it does a definite mathematical approach, is intriguing. The difficulties, however, in such an approach are recognized. Garvey and White (16) in 1933 said in this connection:

"While it would be convenient to have a single quantitative test which could be applied to all types of compound as a measure of the degree of vulcanization, no such test has been found which would be acceptable, even within the limits of compounding and processing used for this study."

Criteria Used in the Present Paper

In determining the rate of cure of present-day whole tire reclaim, the five criteria listed and explained below were used.

1. Mooney scorch at curing temperatures. This work was done in the Midwest laboratory and also in an outside cooperating laboratory. (See test 5 below.) The Midwest results are expressed as the actual time for a rise of one point per minute above the minimum (small rotor). The other results are expressed as the actual time for a rise of two points above the minimum (large rotor). Mooney data represent the time required to reach incipient vulcanization.

2. Modulus and tensile. These were obtained on the Scott tensile tester. These data were plotted against time of cure, and the optimum curing times were read off from the curves; both tensile and modulus were kept in mind. The optimum times which are chosen are those corresponding to or approaching the maximum tensile range.

3. Energy capacity. This is the area contained between the stress-strain curve and the elongation axis and is calculated according to the method of Sheppard (17). [The original study of energy capacity of rubber compounds was made by Wiegand (18-19).] The calculated values were plotted against time of cure, and the optimum curing times were read off, as in the case of tensile data.

4. Elongation at constant load. This was obtained through the kindness of R. D. Stiehler and F. L. Roth, of the National Bureau of Standards, Washington, D. C. Strain data were obtained at two loads: 200 psi. and 400 psi., and from these scorch time (t_o) and rate of cure (k) were calculated. Then from these two values the "preferred" time of cure (t_p) was determined by the method of Schade.

5. Relaxed compression set. This was obtained through the kindness of L. R. Sperberg. In this case the four separate mixes of each compound were blended together on the laboratory mill. Each value shown is the average of three determinations. The conditions of test were: 35% deflection for two hours at 212° F., plus one hour relaxation at 212° F. The values are plotted against time of cure on log paper, which is the method preferred by Sperberg. In this case no attempt is made to pick out optimum cures, but the curing times corresponding to 80, 65, and 30% compression set are tabulated.

Compounds and Procedure

A typical present-day first-quality mixed elastomer whole-tire reclaim designated R-1 was compounded, cured over a wide range, and subjected to the various tests just enumerated. Comparable natural rubber and GR-S control compounds were included (in two different series), and two other reclaims were included in the natural rubber series. All three reclaims were standard commercial grades. They were of comparable quality, specific gravity, and rubber hydrocarbon content, but differed in the kind of rubber hydrocarbon and in the chemical manufacturing process used, as shown in Table 1.

TABLE 1. RECLAIM CHARACTERISTICS

Reclaim	Kind of Rubber Hydrocarbon	Chemical Proces
R-1	Mixed: natural plus GR-S	Neutral
R-2	Natural only	Alkali
R-3	Natural only	Neutral

All compounds were designed to have approximately the same RHC by volume (62.5%). The purpose of adding filler to the reclaim compounds was to improve milling properties and testing accuracy. FF black was selected because, as has been shown by Braendle and coworkers (20), this grade of carbon does not interfere with the rate of vulcanization of a pure gum base.

Table 2 shows the compounds of the natural rubber series. The natural rubber control compound is designated N, and the three reclaim compounds are designated R-1, R-2, and R-3 respectively.

Table 3 shows the compounds of the GR-S series. The GR-S control compound is designated S; the R-1 compound is the same as in Table 2, and the 50/50 GR-S/Reclaim RHC compound is designated R-1 S.

TABLE 2. NATURAL RUBBER SERIES

	N	R-1	R-2	R-3
Smoked sheet	100			
Reclaim, R-1	..	190		
R-2	..	..	190	
R-3	..	..	..	190
Stearic acid	2	2	2	2
FF Black	50	20	20	20
Paris white	65	..	..	..
Circo light oil	10	..	..	..
Zinc oxide	5	5	5	5
Benzothiazyl disulfide	1	1	1	1
Sulfur	3	3	3	3
	236	221	221	221

TABLE 3. GR-S SERIES

	S	R-1	R-1 S
GR-S	100	..	50
Reclaim, R-1	..	190	95
Stearic acid	2	2	2
FF Black	50	20	35
Paris white	65		32.5
Circo light oil	10		5
Zinc oxide	5	5	5
Benzothiazyl disulfide	1	1	1
Sulfur	3	3	3
	236	221	228.5

Four batches of all compounds were mixed and cured, and three test specimens per slab were used. The data for all compounds are given as an appendix (Tables 6-9), and represent the average results on all four batches.

Low curing temperatures of 260 and 270° F. were used so that a definite undercure would be obtained in 10 minutes.

Summary of Results

Natural Rubber Series

A summary of the curing times determined according to our five criteria is shown for the natural rubber series in Table 4 and further explained in Figures 1, 2, 3, and 4.

TABLE 4. SUMMARY OF CURING TIMES

(In Minutes)

Natural Rubber Series

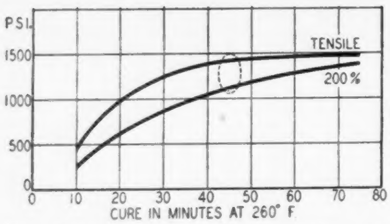
Compound	N	R-1	R-2	R-3
Mooney scorch, 260° F. (Midwest Lab.)	7.5′	10.5′	3.5′	6.0′
270° F. (Coop. Lab.)	7.5	9.25	4.0	5.75
Tensile optimum, 260° F.	27.5-32.5	42.5-47.5	22.5-27.5	25.0-30.0
Energy capacity optimum, 260°F.	25.0-30.0	27.5-32.5	17.5-22.5	20.0-25.0
Calc. pref. time, tp, 260° F., 200 psi.	*27.5	25.4	19.6	19.7
400 psi.	*27.5	27.8	22.6	20.9
Relaxed compression set, 270° F., 80%	13.5	13.5	9.5	12
65%	21	22	22	19.5
30%	58	51	86	52

* Assumed reference point taken from energy capacity data. Note: The value for F_1 in Schade's equation used for calculating the preferred times in this work comes to 0.62, as compared with 0.68 as given by Schade (15). These values for F_1 are from the strain data at 400 psi.

1. The Mooney scorch data of the two laboratories agree in the relative rating of the four compounds. The two natural rubber reclaim compounds, R-2 and R-3, arrive at incipient vulcanization sooner than the natural rubber control compound, N, and the alkali process reclaim compound, R-2, is the fastest. Compound R-1, containing the mixed elastomer reclaim, is slower than compound N.

2. The tensile strength data rate the four compounds in the same order as do the Mooney scorch data. Such agreement, however, is a matter of chance inasmuch as scorch data represent incipient vulcanization; whereas tensile strength data represent a full cure. Compound R-1 containing the mixed elastomer reclaim has a tensile-time of cure curve very similar to that of a GR-S compound. The compound is very slow to reach the tensile optimum. For this reason Compound R-1, judged by tensile strength data, is shown to be much slower curing than the other three compounds.

3. The energy capacity data rate the four compounds in the same order as do the tensile strength data. The



'Fig. 1. Modulus and Tensile vs. Time of Cure at 260° F., Compound R-1. The Dotted Elliptical Enclosure Indicates the Selected Optimum Curing Range

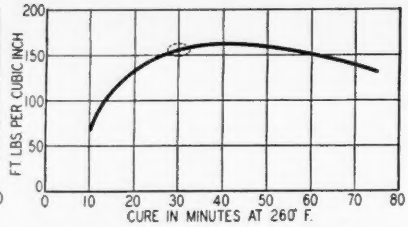


Fig. 2. Energy Capacity vs. Time of Cure at 260° F., Compound R-1. Again the Selected Optimum Curing Range Is Indicated

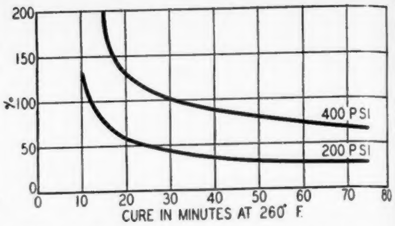


Fig. 3. Elongation at Constant Load vs. Time of Cure at 260° F., Compound R-1. Loads: 200 and 400 pSI.

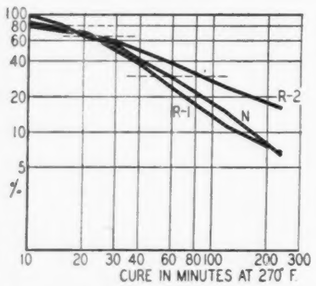


Fig. 4. Relaxed Compression Set vs. Time of Cure at 270° F., Natural Rubber Series. One of the Four Compounds Has Been Omitted for the Sake of a Clear Graph. Horizontal Lines Indicate Three Values for Compression Set for Which Corresponding Curing Times Are Tabulated: 80, 65, and 30%

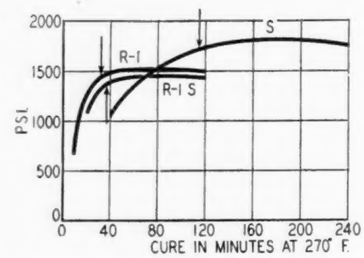


Fig. 5. Tensile Strength vs. Time of Cure at 270° F., GR-S Series. The Vertical Arrows Indicate the Selected Optimum Curing Times

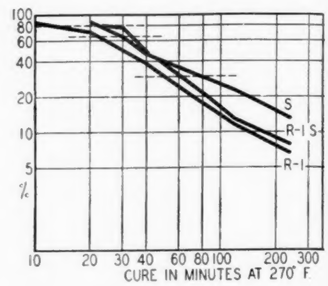


Fig. 6. Relaxed Compression Set, GR-S Series. Horizontal Lines Indicate the Same Three values as in Figure 4

optimum curing time is shorter for each compound than in the case of tensile strength. Compound R-1, containing the mixed elastomer reclaim, is not shown to be abnormally slow curing judged by energy capacity data. In fact it is shown to be quite close to the natural rubber control compound, N.

4. The "preferred" times of cure calculated from strain data divide the four compounds into two groups of two compounds each. The two natural rubber reclaim compounds, R-2 and R-3, comprise one group, faster curing than the other. Within each group the two members have about equal curing rates. These calculated results are in substantial agreement with the energy capacity data.

5. The 80% compression set data represent the region of undercure with respect to tensile optimum. If compression set in this region is solely a measure of state of cure, then the data show all three reclaim compounds to be curing faster than the natural rubber control compound, N. The authors are inclined to the opinion, however, that compression set values in an undercure are not exclusively a measure of state of cure, as it is known that a reclaim compound may be less thermoplastic or more nervy than a comparable natural rubber compound even when both are completely uncured. For example, the data show that compound R-1 has a compression set at the 10-minute cure of only 85.3%; whereas the Mooney scorch time for this compound is relatively long, viz., 9.25 minutes. Compound N, on the other hand, has a compression set at 10 minutes of 99.4% although its Mooney scorch time at curing temperature is relatively short, viz., 7.5 minutes.

6. The 65% compression set data represent roughly the region of optimum cure with respect to tensile. The values for the four compounds are almost identical: 19.5-22 minutes.

7. The 30% compression set data represent the region of overcure with respect to tensile. Compound R-2 containing the alkali process natural rubber reclaim requires a much longer time than the other three compounds to reach this relatively high state of cure. Another way of putting the matter is that Compound R-2, which is fairly scorchy, is difficult to get to a tight state of cure; whereas Compound R-1, which is the least scorchy, vulcanizes to a very tight state of cure.

GR-S Series

A summary of the curing times as determined for the GR-S series are shown in Table 5 and further explained in Figures 5 and 6.

TABLE 5. SUMMARY OF CURING TIMES

(In Minutes)
GR-S Series
All Cures at 270° F.

Compound	S	R-1	R-1 S
Mooney scorch (Midwest Lab.)	17′	10′	15′
(Coop. Lab.)	13.5	9.25	13.5
Tensile optimum	110-120	30-35	35-40
Energy capacity optimum	70-80	15-20	25-30
Relaxed compression set, 80%	23	13.5	23
65%	29	22	32.5
30%	79	51	61

1. Mooney scorch data show the mixed elastomer reclaim compound, R-1, to be the first of the three compounds to reach incipient vulcanization. The other two compounds are almost identical in scorch rate.

2. Tensile optimum data rate the all-reclaim compound, R-1, the fastest of the three compounds, with Compound R-1 S containing the blend of GR-S and reclaim a close second. The GR-S control compound, S, requires a characteristically long time to reach its tensile optimum, way out of line compared with the other two compounds.

3. The optimum curing ranges determined from energy capacity data are all shorter than the corresponding tensile optimums. The three compounds are rated in the same order as in the case of tensile strength.

4. Compression set data at all three percentages, 80, 65, and 30, agree with the other data in rating the all-reclaim compound, R-1, the fastest curing of the three compounds. Compound R-1 also has the tightest cures throughout. The GR-S control compound, S, begins to slow up after about 45 minutes and is difficult to get to a tight state of cure. The compression set of Compound S at tensile optimum (20-25%) is way out of line with the corresponding values for the other two compounds (45-55%).

General

To recapitulate, then, and in terms of the reclaims used and their cures, as compared with the natural rubber, GR-S, and between themselves, we found:

1. With comparable compounds the two natural rubber reclaims, R-2, R-3, used in this work cure faster than smoked sheet.
2. The alkali process natural rubber reclaim, R-2, tends to cure somewhat faster than the corresponding neutral process reclaim, R-3, but is difficult to get to a tight state of cure as measured by compression set.
3. The present-day mixed elastomer reclaim, R-1, tends to cure somewhat slower than smoked sheet, but reaches a very tight state of cure as measured by compression set.
4. The present-day mixed elastomer reclaim cures considerably faster than GR-S.
5. The blend of GR-S and mixed elastomer reclaim, R-1 S, cures considerably faster than straight GR-S and is only slightly slower than straight reclaim, R-1. In other words, the addition of present-day reclaim to GR-S speeds the cure much more than in proportion to the reclaim hydrocarbon content.
6. So far as the authors are aware no results on the curing rate of reclaimed rubber contained in this paper contradict those obtained by previous workers.

Acknowledgment

The grateful thanks of the authors are extended particularly to R. D. Stiehler and F. L. Roth, of the National Bureau of Standards, for a very great amount of testing for elongation at constant load; to L. R. Sperberg for furnishing the relaxed compression set data; to H. A. Braendle, of Columbian Carbon Co., and to G. K. Trimble, D. S. le Beau, and R. E. Cartlidge, of Midwest, for extremely helpful comments and information.

Appendix

TABLE 8. RELAXED COMPRESSION SET %

NATURAL RUBBER AND GR-S SERIES

Cure at 270° F.	Compounds N	R-1	R-2	R-3	S	R-1 S
10′	99.4	85.3	79.5	85.1	....	....
15	81.3	....	74.0	....	....	....
20	67.1	70.7	67.4	65.4	87.6	85.0
30	55.9	....	58.8	53.8	64.4	70.8
40	41.6	38.8	49.7	40.0	45.8	48.3
60	29.1	24.2	38.7	24.3	35.7	30.7
80	22.1	17.5	....	18.0	29.3	21.6
120	14.6	11.2	23.8	13.5	22.1	12.9
180	....	....	....	....	16.5	....
240	6.4	6.6	15.9	8.9	12.9	7.8

TABLE 6. STRESS-STRAIN DATA

NATURAL RUBBER SERIES

Cure at 260° F.	Modulus PSI. at 100%	200%	300%	400%	500%	Tensile PSI.	% Elong.	Energy Capacity Ft. Lbs.-Cu. In.	Shore Hardness
					Compound N				
10′	90	215	410	665	885	940	510	159	48
15	175	375	700	1085	1535	1815	560	342	51
20	215	490	865	1395	1870	2010	520	357	59
30	295	620	1040	1600	2175	2210	505	396	61
45	355	695	1145	1740		2195	485	395	63
75	410	770	1265	1935		194′	425	325	68
					Compound R-1				
10′	130	295	430			445	340	68	54
15	180	375	585			660	360	102	57
20	280	625	980			1000	320	133	64
30	375	835	1230			1245	305	157	67
45	495	1125				1420	270	162	70
75	610	1380				1470	220	132	76
					Compound R-2				
10′	235	440	600	810		915	445	172	57
15	310	595	840	1070		1100	420	208	60
20	395	740	1085	1250		1260	405	242	66
30	465	850	1210			1340	340	203	68
45	560	995	1355			1395	325	215	70
75	585	1015	1365			1400	305	196	72
					Compound R-3				
10′	215	410	660	835		870	420	156	60
15	330	620	960			1120	360	171	63
20	390	770	1165			1310	345	193	67
30	535	1050	1400			1455	305	197	71
45	560	1140				1500	270	171	72
75	605	1195				1490	260	167	73

TABLE 7. STRESS-STRAIN DATA

GR-S SERIES

Cure at 270° F.	Modulus PSI. at 100%	200%	300%	400%	500%	Tensile PSI.	% Elong.	Energy Capacity Ft. Lbs.-Cu. In.	Shore Hardness
					Compound S				
40′	150	220	400	610	845	1035	605	230	55
60	175	290	545	850	1190	1375	570	280	57
80	195	345	665	1030	1435	1535	535	290	60
120	210	435	850	1335		1745	490	295	62
180	235	520	1055	1620		1800	430	260	65
240	270	590	1155			1765	390	235	66
					Compound R-1				
10′	195	365	540			670	380	110	58
20	355	755	1090			1240	345	185	65
40	530	1115				1490	275	175	74
60	600	1255				1505	245	155	76
80	610	1300				1515	230	140	77
120	640	1310				1490	220	130	77
					Compound R-1 S				
20′	360	625	890			1080	380	185	69
30	425	765	1125			1340	360	210	72
40	470	855	1315			1395	325	195	74
60	530	970				1420	295	180	75
80	545	1015				1445	285	175	76
120	540	1020				1425	275	165	77

(*Continued on page 66*)

Non-Injurious Copper in Textiles to Be Rubberized

Samuel Lee,[1] M. W. Weiss,[2] and Erik Hoffmann[2]

TO THE medieval alchemist, copper was known as "Meretrix Metallorum"—the harlot of metals (1)[3]—because of its proclivity for combining with so many different chemicals. In many modern industries it is often referred to in equally picturesque language because of its tendency to poison the product that it contaminates. In the petroleum industry both gasoline and lubricating oil must be completely free from copper to avoid corrosion of engines and machines. In the television industry, components of the picture tube must contain less than one part per million of copper, else the picture exhibits a ghastly greenish tinge.

In the rubber industry the deleterious effects of copper upon rubber were first reported in 1889 by Burghardt (2) who referred to the poor aging of stock treated with cupric oxide in the presence of olive oil. Shortly afterward (3) it was demonstrated that solutions of metal salts painted on the surface of the rubber caused the destruction of acid-cured rubber when heated in an oven at 140° F. Inasmuch as the metallic ions used (iron, copper, mercury, and manganese) were all capable of existing at several valence states, it was deduced that this phenomenon was one of oxidation-reduction, with the metallic ion functioning as catalyst.

The precise mechanism of the deteriorating effect of copper upon rubber has not been finally established. One theory (4) suggests that ionic copper is reduced to the cuprous state by the unsaturated linkages of the rubber molecule. These cuprous ions then absorb atmospheric oxygen to revert to the cupric state. This oxygen is transferred to the double-bonds of the rubber to form peroxides, with the copper again being reduced to the cuprous state. The cycle is repeated until the rubber has completely deteriorated. This hypothesis implies that any metal capable of forming two or more oxides, the oxide of the higher valence being stable in air and unstable in the presence of organic double-bonds, would serve as an oxidation catalyst.

The copper content of natural rubber may vary widely, depending upon the soil in which the trees grow, the fertilizer added, and the chemicals and equipment used in extracting, processing, and storage. In 1913, Beadle and Stevens (4) reported to the Rubber Growers Association that the 0.01 to 0.02% copper present in the acetic acid used for coagulating latex on the estate was ample for producing tackiness in the raw rubber. Since coagulating acid is used in extreme dilution, the amount of copper ions retained would have been extremely small.

Hastings and Sekar (5) noted that "although the aging properties of raw rubber derived from latex to which have been added copper ions of the order of 0.0005% do not appear to be altered after storage for several months, the plasticity shows a slight progressive difference and the rubber tends to become softer." Flint (6) feels that "traces of copper appear to affect plasticity without affecting aging properties"; but softening, when due to catalyst activity, is usually a precursor of other aging changes.

Rubber that is completely free from copper is rare in commerce. Van Rossem (7) reports the natural content of copper in raw rubber to be of the order of 0.0003%. It has been suggested that the "natural" aging which rubber undergoes is in reality primarily due to this minute content of copper and possibly other metallic oxidation catalysts.

If it can be demonstrated that the rate of deterioration of rubber is a linear function of its copper content, it may become possible to predict the service life of a rubber product on the basis of its metallic content. It is undoubtedly too much to expect rubber growers to produce rubber entirely free from metallic ions.

Taylor and Jones (8) press-cured a series of natural rubber specimens containing various percentages of added copper and determined their aging qualities by the oxygen bomb test and the Geer oven test. Table 1 summarizes their results when 0.001% copper as stearate was incorporated. When the copper concentration was increased to 0.01% or greater, the rubber liquefied.

TABLE 1. EFFECT OF COPPER ON NATURAL RUBBER

OXYGEN BOMB TEST

	Original		Time in Bomb: 48 Hours		96 Hours		144 Hours	
	Tens. PSI.	Elong. %	Tens. PSI.	Elong. %	Tens. PSI.	Elong. %	Tens. PSI.	Elong. %
Blank	259	677	172	583	79	376	50	307
0.001% Cu (as stearate)	249	683	110	423	57	288	43	218

GEER OVEN TEST

	Original		Time in Oven: 5 Days		9 Days		14 Days	
	Tens. PSI.	Elong. %	Tens. PSI.	Elong. %	Tens. PSI.	Elong. %	Tens. PSI.	Elong. %
Blank	259	677	211	600	182	570	98	392
0.001% Cu (as stearate)	249	683	174	457	128	397	88	253

Copper in Fabrics for Rubber

Ever since more than a century ago, when Charles Mackintosh spread rubber cement over a fabric and invented the raincoat that bears his name (the mackintosh), the marriage of textiles and rubber has been a happy one. Numerous modern products—automobile tires, industrial belting, carpeting, bathing suits and foundation garments, etc.—serve as constant reminders of the improvements in properties resulting from the combination of textile fibers with elastomeric polymers.

It is, therefore, equally imperative that all fabrics which are to be rubberized be equally free from deleterious copper. As early as 1926 (9) it was reported by the Netherlands Government Rubber Institute that samples of colored fabric lined with rubber solution were sent to the Delft Institute with the complaint that the rubber had lost its adhesive properties upon aging. Some were gold and silver brocade containing large amounts of copper, and it was obvious that deterioration

[1] Interchemical Corp., textile colors division, Hawthorne, N. J.
[2] Interchemical Corp., research laboratories, 432 W. 45th St., New York, N. Y.
[3] Numbers in parentheses refer to Bibliography items at end of this article.

of the rubber was due to the cupric ions found in an acetone extract of the samples.

Under present specifications textile products for rubber coating must not contain more than minute amounts of copper or manganese. The limits most commonly specified are 0.001% copper and 0.0005% manganese (10). Implicit in these limitations is the premise that any or all forms of these elements may be harmful to rubber. This view does not appear to be justified in the light of present knowledge. Although this discussion deals only with copper, the necessity of differentiating between non-injurious and harmful compounds is probably applicable to manganese as well.

The specific effects of injurious copper compounds have been investigated extensively (11). Even minute amounts may depolymerize raw rubber, making it soft and sticky; in vulcanized rubber such copper compounds promote oxidation and accelerate aging, causing embrittlement with serious reduction in tensile strength and elasticity. Neoprene and GR-S synthetic rubber, as well as the natural product, are adversely affected (12).

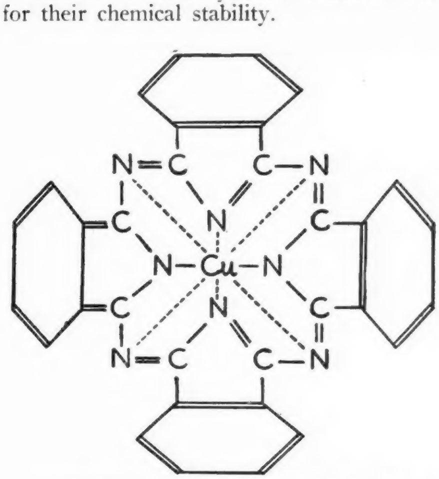
It is generally accepted at present that only those copper compounds are potentially injurious which are capable of dissociation or can form ionizable compounds under the conditions of vulcanization. Salts, such as cupric sulfate and chloride, and soaps like the oleate, stearate, or naphthenate, are particularly injurious. Cuprous or cupric oxide, which may react with vulcanizing agents to form soluble, ionizable compounds, and cupric sulfide which may oxidize to the sulfate, are likewise harmful. Fatty acids, and possibly other oily substances, promote the injurious effects of active copper compounds, probably by increasing their solubility in rubber. For this reason it is also specified that the content of "grease," or material extractable with benzene, must not be more than 1% in textiles offered for rubber coating.

As proof that the deleterious effects result from copper ions, it has been demonstrated that certain organic compounds which are capable of forming stable non-ionic copper complexes are effective "inhibiters" or "deactivators." For example, copper oleate, which is very injurious to rubber, is rendered harmless in the presence of 8-quinolinol or mercaptobenzimidazol (13). The injurious effects of traces of copper ions in promoting the oxidation of petroleum products is likewise counteracted by suitable organic deactivators (14).

Harmful copper in textiles may originate in contamination from machinery parts such as dry cans or rolls, or as residues left in the goods after chemical processing (bleaching, scouring, dyeing, etc.) (15). With reasonable care in handling and processing, cotton goods containing less than the allowable maximum of ionizable copper and acceptable to the rubber coating industry can be produced without great difficulty.

Compounds in which the copper is not free to form ions are harmless to rubber. A prime example of such a compound is copper phthalocyanine, which possesses the structure shown below.

The copper atom in this molecule is held by primary as well as secondary or "coordinated" valences (the latter indicated by dotted lines) forming a "chelate ring." The term "chelate" was proposed by Morgan (16) to designate cyclic structures arising from the union of metallic atoms with organic and inorganic molecules. It is derived from the Greek word "chela"—the great claw of the lobster and other crustaceans—and is applicable to these ring systems because of the caliper-like character of the associating molecule. In this form the copper cannot undergo the characteristic reactions of its ions. The well-known pigments, phthalocyanine blue and green, which have basically the structure below, are noted for their chemical stability.



COPPER PHTHALOCYANINE

In this connection it is pertinent to quote from an authoritative discussion of the phthalocyanines published in 1939 by M. A. Dahlen, of E. I du Pont de Nemours & Co., Inc. (17):

"Copper phthalocyanine was adopted immediately in the rubber trade for the production of brilliant shades of blue, ranging from deep reddish blues to greenish pastel shades. The color is fast to all conditions of vulcanization, offers no difficulty due to migration, and, broadly speaking, meets all the requirements of rubber processing. It is of particular interest that, although the pigment contains copper and that even traces of ionizable copper catalyze the destruction of rubber, copper phthalocyanine is without effect. This is striking proof of the 'tight' nitrogen to copper bond in the molecule."

Evidence confirming the above view was furnished as a result of an investigation by the Research Association of British Rubber Manufacturers, reported in 1947 (18).

Typical rubber vulcanizates such as might be used for bathing caps were prepared in accordance with recipes in Table 2. No antioxidant was included for fear it might mask the deleterious action of the copper. The copper content in B of more than 0.1% is normally highly detrimental upon aging. Sheets of each mixing six- by six- by 0.1-inch were vulcanized in frame molds between stainless steel cover plates in a platen press at 141° C. Dumbbell tensile test specimens were cut from the vulcanizate and tested on the Scott machine. It is obvious from the results in Table 3 that the copper present in the pigment has not produced the disastrous effect upon aging normally associated with such large amounts of copper.

Table 2

	A	B
Pale crepe	100	100
Sulfur	2.5	2.5
Barytes	45	45
TiO_2	10	10
ZnO	5	5
Stearic acid	1	1
Mercaptobenzothiazole	0.75	0.75
Copper phthalocyanine	....	2

It was concluded that "there is thus no evidence that the copper present in copper phthalocyanine has any appreciable detrimental effect on the aging of vulcanized rubber under the conditions examined. These results, obtained with a mix containing a relatively enormous amount of copper, demonstrate in striking fashion how copper can be rendered inert by introducing it into certain types of chemical molecules."

Table 3. Influence of Copper Containing Pigments

Aging	Time	Tensile Strength PSI. A	Tensile Strength PSI. B	Elongation at Break (%) A	Elongation at Break (%) B	Modulus 500% PSI. A	Modulus 500% PSI. B
Unaged	....	2790	2830	785	770	620	630
Oxygen bomb*	48 hrs.	2770	2770	740	725	750	805
	96 hrs.	2520	2300	710	690	830	790
Outdoor†	18 days	2090	2230	680	705	760	710
Geer oven‡	10 days	1680	1570	570	545	1075	1140
	15 days	1390	1390	515	490	1240	1275

* At 70° C., 300 psi. oxygen pressure. † Horizontally under glass during August. ‡ At 70° C. atmospheric pressure.

Since the copper compound had no appreciable detrimental effect on aging under any of the conditions tested, it was concluded that: "copper can be present in extremely high percentages, yet do no harm to the aging properties of vulcanized rubber, provided it is rendered inert by chemical combination in certain types of compounds."

The copper phthalocyanines, as is well known, are also among the most stable colorants for textiles and are extensively employed for this purpose. Under present specifications, however, no distinction is made between harmless and injurious forms of copper, with regard to their effects on rubber. In consequence, any fabric containing copper colorants is considered unsuitable for rubberizing, even though, as in the case of copper phthalocyanine, the same pigment is actually employed for coloring rubber goods. It should be pointed out that the restrictions on copper content in textiles came into force before the phthalocyanines were available and have remained essentially unchanged for many years.

New Method for Copper in Textiles

In view of the fundamental chemical differences between the injurious and non-injurious types of copper it should be possible to distinguish between them readily by suitable tests. Metallic copper and ionizable components likely to be present in textile products are readily soluble, for example, in dilute nitric acid. On the other hand, stable complex compounds such as copper phthalocyanine are not affected by dilute acids at room temperature, but require hot or concentrated reagents.

To demonstrate this point, cotton cloth printed with a phthalocyanine blue dispersion was treated with dilute (1 normal) nitric acid. The extract from printed areas contained only the trace amount of copper (approximately 0.0002%) which was obtainable from unprinted areas of the cloth, proving that the phthalocyanine had not undergone appreciable decomposition. However, when even small percentages of such compounds as cupric oxide, carbonate or sulfate, or cuprous oxide, were incorporated in the phthalocyanine printing paste, their presence was readily detectable by a significant increase in the copper content of the nitric acid extract of the printed fabric.

The copper in complex or chelated compounds can be detected only after conversion to the ionic, soluble form, and all analytical methods of establishing the presence of this element are actually tests for copper ions. The current standard methods for testing fabrics involve the destruction of all organic matter by digestion with hot, concentrated oxidizing acid mixtures (19-20). Under these conditions all the copper present is finally in the ionic condition, including that originally present as harmless compounds as well as injurious forms. Consequently, when destructive digestion is employed, it is not possible to make any distinction between them. The use of hot oxidizing acid mixtures for destroying organic matter associated with copper was established long before the introduction of phthalocyanine colorants in the textile industry, but it has continued to be specified as the standard method for testing fabrics to be rubberized. It is obviously not suitable under present conditions.

A reliable analytical method for detecting and determining the content of injurious copper in textiles appears to be available, as a result of experiments carried out jointly at the research laboratory and the textile colors division laboratory of Interchemical Corp. Standard "80-square" cotton print cloth was employed. Cupric oxalate (C.P.) was incorporated in a printing paste applied to one piece of the cloth by a laboratory printing machine. A dilute solution of copper stearate (commercial grade) in xylene was applied to another piece of cloth, using a microset laboratory padder, and the solvent was evaporated by air drying. A third piece was similarly treated with a dilute solution of commercial copper naphthenate in xylene and dried in the same way.

The actual copper content of each piece was determined on five-gram samples by destructive digestion with boiling mixtures of nitric and sulfuric acids, followed by electrolytic deposition on platinum electrodes. Blank tests run on the same volumes of acids used in the determinations produced weighable amounts of copper which were deducted from the total to give the corrected copper content.

The copper content was also determined on each piece by extracting five-gram samples with 1-normal nitric acid at room temperature. Aliquots of the extracts, containing 5-15 micrograms of copper, were made ammoniacal, treated with sodium diethyl dithiocarbamate reagent (19) and diluted in Nessler tubes to 100 milliliters. The copper content was estimated colorimetrically by comparison with a series of tubes prepared in the same way from aliquots of a standard copper sulfate solution, in steps differing by one microgram. Blank tests on the reagents were used to correct the results.

The data from these tests are tabulated below:

Copper Compound on Print Cloth	Copper Content: Hot Digestion-Electrolysis Method %	Copper Content: Extraction-Colorimetric Method %	Percentage of Copper Recovered by Extraction
Copper stearate	0.027	0.029	107
Copper naphthenate	0.018	0.017	95
Copper oxalate	0.038	0.035	92

The copper in these three water-insoluble compounds, which were present as small percentages dried into cotton cloth, was thus extractable with practically complete recovery by 1-normal nitric acid. It is unlikely that any copper compound potentially harmful to rubber would escape detection by this method.

These results appear to justify the proposal that extraction with dilute nitric acid should replace the hot acid digestion method in testing textile products for harmful copper.

The following procedure is recommended for this purpose:

Reagents

Nitric acid, 1 normal: 64 milliliters (91 grams) of concentrated nitric acid (specific gravity 1.42), A. C. S. purity, diluted to one liter with copper-free distilled water.

Ammonium hydroxide, concentrated (A. C. S. grade).

Sodium diethyl dithiocarbamate reagent: one gram of sodium diethyl dithiocarbamate (Eastman or equivalent purity) dissolved in one liter of water.

Standard copper solution: Dissolve 3.94 grams of copper sulfate crystals ($CuSO_4.5\ H_2O$), A. C. S. purity, in 100 milliliters of distilled water containing one milliliter of dilute (6 normal) sulfuric acid, and dilute to one liter in a volumetric flask. Check the copper content of this solution by titration with 0.1 normal sodium thiosulfate solution. Prepare the standard copper solution, containing 0.00001-gram (10 micrograms) of copper per milliliter, by diluting an aliquot.

Procedure

Place a five-gram sample in a 100-milliliter Erlenmeyer flask fitted with a ground glass stopper, and add 50 milliliters of 1-normal nitric acid. Stopper the flask, and shake vigorously to insure complete wetting of the sample; then allow it to stand 2-4 hours with occasional shaking. Pour the liquid into a 100-milliliter beaker, and wash the sample with two 10-milliliter portions of N nitric acid, adding these to the beaker.

Neutralize the solution with ammonium hydroxide, adding a slight excess. Heat just to boiling and allow to stand on a steam bath for at least one hour, to insure complete precipitation of iron and aluminum hydroxides. Filter the solution, while it is still hot, through a Gooch crucible with asbestos mat or a funnel with a sintered glass disk, collecting the filtrate in a 100-milliliter Nessler tube. Wash the filter with 10 milliliters of a 1% ammonia solution. After cooling the tube to room temperature, add 10 milliliters of the diethyl dithiocarbamate reagent followed by distilled water to bring the level of solution to the 100-milliliter mark.

Into a second 100-milliliter Nessler tube, pipet five milliliters of the standard copper solution and add 70 milliliters of 1-normal nitric acid. Make the solution slightly alkaline with concentrated ammonium hydroxide; add 10 milliliters of carbamate reagent, and fill the tube to the mark with water. This solution contains 0.00005-gram (50 micrograms) of copper, equivalent to 0.001% in a five-gram sample.

If the intensity of color in the tube containing the extract does not exceed that in the standard tube, the sample contains not more than 0.001% of copper in a form harmful to rubber and may be considered acceptable for rubberizing.

With suitable modifications the same procedure may be employed for the determination of the actual content of harmful copper. In this case the ammoniacal filtrate is collected in a volumetric flask, and aliquots are taken for colorimetric assay by any standard method (19-21). The sensitivity of the diethyl dithiocarbamate reagent permits the detection of 0.0001% of copper in a five-gram sample, i.e., 1/10 or less of the maximum content allowable under present specifications (21).

As a rule, treatment of the nitric acid extract with ammonia, followed by filtration of any precipitate, will remove all substances which might interfere with the colorimetric procedure. However, if the extract contains a colorant not removed by the ammonia treatment, it can be decolorized by digestion with hot oxidizing acids. Electrolytic deposition of the copper in colored solutions is an alternative possibility.

It should be emphasized that copper compounds which might be injurious to rubber are quantitatively extracted from textile samples by 1-normal nitric acid at or near room temperature. Treatment at elevated temperatures is not only unnecessary, but may actually result in appreciable decomposition of harmless copper compounds and thus give misleading results.

Summary

It is generally recognized that although "free" or "ionic" copper even in minute amounts may be extremely injurious to rubber, the combined copper in certain textile colorants is essentially harmless. Present methods of testing involve the complete destruction of the sample and the conversion of harmless combined copper into the free form in order to permit detection and estimation. Such procedures, therefore, do not allow differentiation between free and combined copper, and, thus, according to present specifications, classify as unsuitable for rubber coating any fabrics colored, for example, with phthalocyanine pigments. A method is proposed for detecting only the injurious copper in textile products, with ample sensitivity to meet present requirements.

Acknowledgment

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Recent Developments in

The Physics of Rubber

S. D. Gehman[1]

In 1949, India Rubber World began the practice of running a series of short summary articles on developments in various branches of the rubber and plastics industries and their technologies during the first half of the year following the year in which these events occurred.

As a continuation of this practice, short articles on the developments in 1950 in the physics of rubber, in plastics, and in reclaimed rubber, prepared by leaders in these fields are presented herewith. Similar articles on other subjects will be presented in future issues. Editor.

DURING recent months the physicists of the rubber industry found themselves again largely preoccupied with evaluations of experimental synthetic rubbers both for special applications and for general purposes in the emergency. This reexamination of the basis for rubber-like properties goes beyond the development of testing methods and procedures, although these are frequently valuable by-products of such work. It has its greatest value when it affords new insight into principles of rubber-like elasticity which may be adapted to accomplish improvements in quality.

An interesting case in point concerns the cold weather buckling difficulties with Butyl rubber inner tubes. Low temperature stiffening was not the cause of the trouble. The buckling was shown to be due to the large internal molecular friction in Butyl rubber at low temperatures.[2] Once the difficulty was clearly understood, remedial measures both in compounding and in the molecular structure of the Butyl rubber were accomplished.

There is evidence of an increasing realization among physicists of the shortcomings of the kinetic theory of rubber elasticity for dealing with many practical problems involving non-equilibrium deformations, low temperature behavior, and carbon black reinforcement. Progress has been made in the last year both in theoretical and experimental extensions of the field of viscoelastic behavior of rubber. This work gives promise of correcting some of the inadequacies of older concepts by taking better account of the intermolecular forces.

In a period when the most intensive activity in physics is in the field of atomic structure, it would be strange indeed if some applications from this new knowledge did not occur for rubber. Sulfur is an important atom in rubber chemistry, and it happens that sulfur has a radioactive isotope, S35, which is very well suited for tracer work from the standpoint of its availability from Oak Ridge and its half life and type of radiation. This isotope has the same chemical properties as ordinary sulfur, but has the advantage that it can be detected and measured in extremely small amounts by physical means such as a Geiger-Mueller counter.

The use of radiosulfur as a tracer or tagged atom for emulsion polymerization catalysts has been described in several investigations.[3] More recently its use has been reported for an investigation of vulcanization reactions.[4] Evidently a start has been made in utilizing in rubber chemistry techniques which have become available as a consequence of the atomic energy program. The method appears to be capable of supplying information not obtainable in any other way. It remains to be seen how widely applicable and useful it will be.

Another interesting development of an advanced nature has been the use of methods worked out for the study of nuclear magnetism in order to investigate the character of molecular rotations in rubber.[5-6] For a long time it has been presumed from a variety of lines of evidence that free rotation occurred about the carbon-carbon valence bonds of the chain molecules of rubber. The results from the nuclear magnetism experiments confirm this free rotation. The interpretation of the results is that the frequency of free rotation must be much greater than the frequency of the radio-frequency field used, which was 30 million cycles per second.

The Plastics Industry

E. L. Kropscott[7] **and F. J. Mac Rae**[7]

DURING 1950 the plastics industry continued its rapid rate of growth. Late in the year raw material shortages were encountered; the industry, however, continued to consume plastic at an unprecedented rate. Material supplies were pressed to maintain delivery to well-established uses, and development work of previous years resulted in the addition of many new applications.

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Construction of additional production facilities for resin, plasticizers, and intermediates continued during the year, and more plants were planned by the industry for 1951. Several new raw materials and new suppliers entered the field in 1950; thus it is expected that plastic consumption will exceed the all-time high established in 1949. This expectation may be attributed to the following:

(1) The development of new techniques in plastics fabrication.

(2) Further utilization of the unusual properties of plastic compounds and new materials.

The thermoplastic molding industry is a good example wherein the utilization of new techniques resulted in increased consumption. Research work on flow and fluidity of thermoplastic materials has led to a better understanding of the fundamental considerations of injection molding. As a consequence, better principles of balanced flow and restricted gating as well as controlled resistance to flow have been developed. Improved injection molding techniques include mold temperature cycling and improved molding compounds through internal and external lubrication. These techniques have permitted the molder to produce better parts faster at greatly reduced costs. In many instances parts considered impractical for injection molding a year or so ago are being mass produced.

Large injection molding presses up to 200 ounces were built and placed in operation during 1950. These machines permit the production of large plastic parts with a minimum of manpower and, consequently, lower costs. The coloring of molding powder by the fabricator has proved to be economical in many instances.

The compression molding of thermosetting resins has also made some outstanding advances during the year. The introduction of new fast-curing formulations and larger equipment has resulted in the production of complex parts weighing 70 pounds or more.

Improved techniques in the extrusion of resins such as polyethylene has led to widespread acceptance of these films in the packaging field. The hot melt coating of paper via an extruder has permitted paper coaters to produce coated paper with outstanding properties at greatly reduced costs. Special techniques permit the extrusion of seamless tubing better than 100 inches in flat width.

The use of resins such as polyvinyl chloride for extrusion, calendering, and paste fabrication continued at such a rate that a critical shortage developed the last quarter of 1950.

Plastics in the form of latices found widespread commercial usage in 1950 in paints, paper coatings, and textile finishes. The increased demand for textiles combined with the high-cost natural fibers proved an added stimulus to the development of plastic fibers. Nylon continued to expand in the clothing and industrial fabric fields. New products such as Orlon began appearing on the retailers' shelves. Large-scale production plants are planned for textile products from acrylonitrile or copolymers thereof.

Plastic foams found wider usage during 1950 in low-temperature insulation, decorative and novelty fields as well as synthetic sponges.

A review of a few plastic applications will indicate a strong swing during 1950 from novelty to industrial usage for plastic products. One domestic refrigerator manufacturer now uses seven plastic materials for 68 parts in one of his 1950 models. Each unit requires better than 24 pounds of plastic materials.

Typical uses for plastics in domestic refrigerators are extruded vinyl for door gaskets, molded polystyrene for exterior and interior items, and expanded polystyrene for insulation for "flip lids" on a cold cabinet.

The replacement of Holland cloth by extruded polyethylene film in the rubber industry is another example of industrial application for plastic materials.

The toy and model fields have accepted molded plastics with enthusiasm since they permit realism with economy.

The use of nylon instead of metal for gears, rollers, and other mechanical parts, since such items when molded of nylon have less wear and do not require lubrication, has expanded during the past year.

Formed parts from sheeting made of styrene-butadiene-acrylonitrile blends have been accepted by the trade for camera and typewriter cases. This colorful, tough product, called Royalite, has also been formed into several automotive parts used on 1950 and 1951 models.

It is difficult to predict what the future development trend in the plastics industry will be. It is quite evident, however, that plastic materials will have a definite role in any mobilization program. This will in turn affect many of the civilian applications, since any shift to rearmament on top of a record peacetime consumption will bring back shortages and controls.

Reclaimed Rubber in 1950

J. M. Ball[8]

THE year 1950 baffled the experts; everything connected with rubber went up. The price and the consumption of natural rubber, GR-S, and reclaimed rubber all went up. The consumption of new and reclaimed rubber broke all records, and the relative position of reclaimed rubber improved.

The consumption of new rubber rose about 26% (from 988,900 to 1,246,300 long tons) over the corresponding figure for 1949; whereas the consumption of reclaimed rubber rose about 36% (from 222,700 to 302,600 long tons). This means that the consumption ratio of reclaimed to total new rubber rose from 22.5 to 24.3%.

The reclaiming industry in 1950 operated at an average capacity of about 80% on a 6½-day week, 24 hours per day basis. The big pickup in business began during the latter part of May, one full month before the fighting began in Korea.

The price ratio of new rubber (defined for this purpose as natural plus GR-S) to reclaimed rubber, which had fallen to a postwar low, began to rise slowly in 1950, faster in April, and spectacularly in July. This rise continued every month without interruption until December, when it fell off just slightly.

Owing to advances in the price of scrap rubber there were two compensating advances in the price of first-quality whole tire reclaimed rubber: one in July and one in August; the total advance was from 8¼ to 10¢ a

[8] Midwest Rubber Reclaiming Co., East St. Louis, Ill.

pound. Beginning in August the price was on a spot basis. The effect of these higher prices, however, was completely nullified by the simultaneous and continuing advances in the price of new rubber.

The consumption ratio of reclaimed to total new rubber went up about four percentage points in September and another four percentage points in November. The demand for reclaim responded not only to the law of the market, but also to shortages of new rubber, either real or imposed.

The index of wholesale prices of semi-manufactured articles began to rise in May and continued to rise throughout the year. The price of whole tire reclaim, however, as already mentioned, remained constant from August on.

In spite of the August 25 amendment to R-1, the purpose of which was to limit total new rubber consumption during the period September 1 through December 31, the October consumption of new rubber plus reclaim reached the staggering total of more than 156,000 long tons. The M-2 order of November 1, however, was effective, resulting in a lowering of that total for November to less than 130,000 long tons. For December the total was about the same as for November. Naturally when manufacturers could not get all the new rubber they wanted, they reached out for still more reclaim, with the result that the consumption ratio of reclaim to total new rubber went up to more than 30% for November and December.

In transportation items the consumption ratio of reclaimed to total new rubber for the year 1950 was about 17.5%, which compares with about 16.8% for 1949. At the end of 1950 this ratio was more than 22%.

In non-transportation items the consumption ratio for 1950 was about 37% as compared with about 35% for 1949. At the end of 1950 the ratio was more than 44%.

For 1950, as for 1949, it was still true that about two-thirds of the total new rubber and one-half of the reclaimed rubber used went into transportation items.[9]

An extremely strong demand for inner tube and light-colored reclaims developed in the latter half of the year, greatly exceeding the supply. The supply of the corresponding scrap became uncertain, and the price went very high. The result was a spot market for this type of reclaim as well as for whole tire reclaim.

In conclusion 1950 was primarily a production year. As the nation's reclaiming capacity is increased, and as the new higher demands are met, the industry will be able to resume its efforts in technological advance.

The Sole and Heel Industry

THE steadily increasing use of other than leather bottoms on new shoes of all types has built up a close community of interests between the sole and heel industry and the shoe manufacturing industry. Now, it may be truly stated—

"As the shoe manufacturing industry goes, so goes the sole and heel industry."

The trend toward lower shoe sales and reduced per capita consumption of shoes carried over from late 1949 well into 1950. The resulting production by "fits and starts" in the shoe industry was reflected by general lower production trends in the sole and heel industry well into June.

Following the annual industry vacation period, shoe production stepped up appreciably. August hit a year's high of 48,000,000 pairs of shoes, resulting in peak production in heel and sole factories, which carried on practically through December.

Coming events began to cast their shadow before as the military shoe program began to take more definite form in August, yet only in a small way insofar as actual commitments were concerned. This small military beginning, however, served to stimulate civilian production, possibly as a hedge against anticipated raw material price increases and the far-removed possibility of future shoe rationing.

The second half-year's accelerated shoe production brought the total 1950 shoe production figures up to 491,000,000 pairs, as against 473,000,000 pairs for 1949, an increase of nearly 4%.

Last year's sole and heel industry shipments of soles, heels, and slabs to the shoe manufacturing industry was up 10 to 15%, 15 to 20% and approximately 8%, respectively, over 1949 figures.

The elastomer-resin soles, a comparatively new development, have already replaced a large percentage of leather soles on shoes. Superior properties, such as longer wear, waterproof qualities, adequate firmness, exceptional flex life and excellent low-temperature performance, have contributed largely to the acceptance of this new type of sole. All these outstanding properties have been secured without sacrificing light weight, and such soles also have the added advantage of being offered in a wide range of colors.

The elastomer-resin insoles were first offered to shoe manufacturers in 1950. Introduced at a most opportune time when leather insole prices were exceptionally high and difficult to secure, this new member of the elastomer-resin family met with an immediate wide acceptance.

With the world supply of hides seemingly certain to become an increasingly serious problem, elastomer-resin outsoles and insoles will continue to fulfill a real economic need in increasingly large quantities.

Just as the shoe manufacturing industry encountered cutbacks in consumer shoe sales, so too is the shoe repair industry experiencing a serious shrinkage in shoe repair volume. There is apparently some disagreement as to the reason, but no disagreement that it is a definite *trend.* Definitely less shoe repairing is being done.

This condition was reflected in the low sales to the shoe repair industry during the early months of 1950. However, under the impact of "coming events," sales for the last half of 1950 pushed the total sales for the year well over those of 1949.

Sole and heel manufacturers, particularly the compounders and technicians, faced many difficult and bothersome problems in 1950. Fluctuations in the price and availability of natural and synthetic rubber were responsible for several complet changes in compound formulation. Material scarcities in Silene, high styrene resins, and various colors also necessitated further changes.

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[9] The last issue of the United States Department of Commerce industry report, *Rubber*, which was regularly prepared by Everett G. Holt, was that of September, 1950. That issue contained a good article on reclaim usage. It is a matter for regret that this excellent publication, for security reasons, had to be discontinued.

Finally, natural rubber restrictions and cutbacks in GR-S to a base-period formula through the recent M-2 Rubber Order added further woes and tribulations to the sole and heel compounders.

Not the least of sole and heel production difficulties resulted from the "freeze" on steel which threatened seriously to shut down industry heel production because of lack of steel for washers. The washer situation became so acute, some heel plants were able to operate only on a curtailed ticket for three days a week.

Like many other industries, the sole and heel industry faces many problems beginning in 1951. The transition from a peacetime economy to a partial war economy always results in some production and sales dislocations which take time to resolve.

The sole and heel industry faces the future more secure than ever before in the importance of its relative position in the national economy. The following statement by a nationally recognized leader with years of experience in the shoe business demonstrates that fact:

"The public's reaction to non-leather soles has gone beyond mere acceptance. Consumers have begun to ask for them. When that occurs, a material can no longer be thought of as a substitute any more than nylon or rayon can be thought of as a substitute for silk."

The sole and heel industry has every reason to look forward with confidence and certainty to new and greater developments and expanding interests just as soon as the rubber and raw material situation become stabilized.

The Footwear Industry

THE rubber footwear industry, after two years of low demand for its products because of mild weather during the winter season, found demand at a higher level during the 1950-51 winter period. Production restrictions, as introduced by the government, however, had reduced stocks of footwear somewhat, and during 1951 it will be necessary to make waterproof footwear for civilian use throughout the entire year to provide adequate inventories.

The past year saw some new styling of waterproof shoes including the shorter leg on the over-the-shoe boot for teen-age girls, which was very well received. The number of colors available will be noticeably less during 1951, owing to shortages of both white and colored pigments. Restrictions on the use of natural rubber will also affect future styling.

There was a good demand for tennis shoes during 1950, but here again the shortage of aluminum for eyelets caused some difficulty. Aluminum has been particularly satisfactory for tennis shoe eyelets because of its ductility and resistance to corrosion.

The Armed Forces are interested in an improved design of flying boot, and a new last design is important in connection with proposed five-buckle overshoes for the military. The use of aluminum in the production of these new lasts would have the effect of reducing the amount of new last equipment that could be obtained for civilian waterproof shoes.

In periods of emergency the Army has always ordered large quantities of leather shoe pacs with rubber bottoms, and it is expected that there will be a large military demand for this item in the near future.

With demands of the military increasing steadily while, at the same time, the National Production Authority continues to restrict the use of natural rubber, supplies of rubber footwear for civilian use may be less than normal in the near future. If consumers and manufacturers can balance their purchasing and production, however, rubber footwear for civilian users should be available in reasonable quantities, and the health of the country safeguarded. It will be essential, however, that production be maintained throughout the year in order that there will not be unusually heavy demands made upon raw material suppliers during any short periods of time. There is evidence that this situation is reasonably well understood and accepted since orders are being placed for future delivery as products can be made.

The rubber footwear industry should enjoy a very good year during 1951 and should be able to produce all necessary items for both military and civilian use.

Mechanical Molded Goods

IN THE field of molded mechanical goods, manufacturers of these items have been enjoying peak demand for the civilian market during the past year, but are now experiencing increasing demand from the Armed Services. This change in the source of the demand for their products also involves changes in the types of products to be manufactured in many cases as the production of some civilian items is restricted or eliminated entirely.

One of the most important requirements that will be noted in the new defense orders for mechanical molded goods is the one for service at low temperatures. Requests have been made for products that will be flexible down to —70° F., but will at the same time remain within certain ranges of hardness. This situation emphasizes the need of methods of evaluating service at low temperatures and the need of standards acceptable to the consumer and the manufacturer.

Special GR-S polymers have been developed for low temperature service, and technicians in the industry will need to become acquainted with these and all other means of compounding for cold resistance.

The defense program will also call for many and varied products to meet a wide range of demands which will require blends of neoprene, nitrile, and natural rubbers, as well as the special types of GR-S that have been produced.

A great deal of interest has been shown in the polyacrylic rubbers for O-rings, gaskets, grommets, valve seats, packings, etc. This-type polymer has very

good resistance to elevated temperatures, but is poor in its resistance to low temperatures.

Where resistance to both high and low temperatures is desired, the silicone rubbers have shown promise since this material remains rubber-like over a wide range of temperatures, and its heat resisting properties are excellent.

Many new applications for the high styrene resins have been developed, and this type of material is also in very great demand.

Advances are being made in techniques for transfer molding, and many intricate parts are now being successfully made by this method from both natural and synthetic rubbers. Molding by the transfer method will be a valuable asset to many manufacturers as the defense program moves into high gear.

Many of the parts that will be required by the Armed Forces will require improved rubber-to-metal bonds. Advances have been made in this field, but it is still a major problem with the industry and one that will require much development effort in the near future.

Restrictions on the use of natural rubber for civilian products will create many problems for the mechanical molded goods branch of the industry, but similar situations have been met in the past and may be expected to be handled in the future.

Rate of Cure

(Continued from page 57)

TABLE 9. % ELONGATION AT CONSTANT LOAD

NATURAL RUBBER SERIES

Cure at 260° F.	Observed Values 200 PSI.	Observed Values 400 PSI.		Calculated Values 200 PSI.	Calculated Values 400 PSI.
			Compound N		
10'	152	254		156	248
15	107	196		102	196
20	80	166		80	167
30	58	135		60	136
45	48	116		47	114
75	38	95		38	95
			Compound R-1		
10'	134	Broke		152	395
15	96	199		82	189
20	58	127		61	134
30	44	100		44	98
45	34	80		34	80
75	28	66		28	66
			Compound R-2		
10'	78	192		81	198
15	60	152		57	150
20	46	116		47	119
30	38	98		38	98
45	33	85		33	85
75	33*	84*		29	75
			Compound R-3		
10'	79	183		82	196
15	56	134		54	127
20	44	109		43	105
30	34	85		35	88
45	30	79		31	79
75	30*	78*		26	72

* These values were omitted in the calculations of the vulcanization parameters since reversion has apparently begun.

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Carbon Black Statistics — Fourth Quarter and Year, 1950

Following are statistics for the production, shipments, producers' stocks, and exports of carbon black for the fourth quarter and year, 1950. Furnace blacks are classified as follows: SRF, semi-reinforcing furnace black; HMF, high modulus furnace black; FEF, fast extruding furnace black; and HAF, high abrasion furnace black. Statistics on thermal black are included with SRF black to avoid disclosure of individual company operations.

	Oct. (Thousands of Pounds)	Nov. (Thousands of Pounds)	Dec. (Thousands of Pounds)	Year, 1950
Production:				
Furnace types:				
SRF	30,187	28,491	27,805	301,664
HMF	10,532	9,852	10,907	92,288
FEF	16,134	15,517	15,261	158,306
HAF	18,360	19,892	20,671	212,572
Total	75,213	73,752	74,744	764 830
Contact types	55,314	54,405	55,578	616,653
TOTALS	130,527	128,157	130,322	1,381,483
Shipments:				
Furnace types:				
SRF	30,157	20,025	28,702	333,403
HMF	10,018	9,581	9,841	112,252
FEF	16,235	14,591	16,128	167,851
HAF	18,191	19,969	20,217	224,319
Total	74,601	73,166	74,888	837,825
Contact types	45,936	53,132	56,520	668,911
TOTALS	120,537	126,298	131,408	1,506,736
Producers' Stocks, End of Period:				
Furnace types:				
SRF	7,635	7,101	6,204	6,204
HMF	4,737	5,008	6,074	6,074
FEF	2,538	3,464	2,697	2,697
HAF	6,519	6,442	6,896	6,896
Total	21,429	22,015	21,871	21,871
Contact types	64,893	66,256	65,314	65,314
TOTALS	86,412	88,271	87,185	87,185
Exports:				
Furnace types	10,491	10,182	11,254	133,074
Contact types	24,005	21,365	22,516	266,494
TOTALS	34,496	31,547	33,770	399.568

SOURCE: Bureau of Mines, United States Department of the Interior, Washington, D. C.

"Chemical Facts and Figures." Third Edition, 1950. Manufacturing Chemists' Association, Inc., 246 Woodward Bldg., Washington 5, D. C. Paper, 8 by 10½ inches, 434 pages. Price, $3. This new edition of the M.C.A. chemical fact book contains statistics for the period 1946 through 1949, and some partial data for the first half of 1950, on domestic production, sales, imports, and prices of chemicals, chemical products, and chemical raw materials. In addition, available Canadian chemical and mineral statistics are offered for 1946-1949. Financial records are shown for 100 leading chemical process companies for the period 1939-1949, and a special section on unemployment and wages presents complete statistics on applicable subjects. Special sections are devoted to synthetic resins and synthetic rubber.

Editorials

Rubber Program Administration Improved, But Basic Policy Review Needed

LELAND E. SPENCER, Director of the Rubber Division of the National Production Authority, and his staff are to be complimented on the progress they have made since the first of the year in reorganizing that part of the government's rubber program under the jurisdiction of the NPA, but there continues to be much evidence that the basic policy which the NPA is called upon to implement is in need of thorough and continuing review.

Because of unfortunate and generally unavoidable delays in the efforts of the Reconstruction Finance Corp.'s Office of Rubber Reserve to meet its steadily mounting monthly targets for GR-S production, the policy dictated at higher levels to hold civilian new rubber use to 90,000 tons a month and to achieve an overall average ratio of 70% synthetic to 30% natural rubber in such use may be impractical and even foolhardy, at least for the next few months.

New rubber consumption in the United States has been well above 90,000 tons a month for about a year, and the most recent attempts to return to that level of production for civilian goods alone have and will continue to produce severe dislocations in the fabricating industry. These dislocations have been aggravated by cutbacks during a given month in GR-S programmed for use in that month, necessitated by operating failures in the GR-S plants.

GR-S consumption in January was over 47,000 tons and in February was about 43,000 tons. Unofficial figures estimate GR-S production during these months at about 45,000 tons. With this almost exact balance between production and consumption, and while the fabricating industry was forced to curtail its operations on very short notice because of lost GR-S production, additions to stocks on hand were made. There could be no argument with the need to increase the stocks of GR-S on hand, which were only about 38,000 tons on January 1 1951, but not under the circumstances existing during the first quarter of this year.

GR-S production for March, which was to have been 57,000 tons, will be reduced to about 53,500 tons as the result of an explosion and fire at one of the government butadiene plants during the month, and this reduction is not expected to be made up before May 1. There are also indications that the NPA intends to reduce the April allocation of GR-S for civilian goods by about 15%, or to about 47,000 tons.

Consumption of GR-S for military orders, which may amount to between 10,000 and 15,000 tons, will either have to come out of the very small stocks of GR-S on hand or from the allocation for civilian goods. Operation under conditions where there is so little difference between rubber production and use provides no safety factor against any further losses of GR-S production during the next several months.

The overall situation would seem to resolve itself, therefore, into the advisability of a gradual rather than a sharp drop to the 90,000 ton new rubber consumption figure and certainly would not seem to support the logic of reducing the amount of new rubber for civilian goods below 85,000 tons a month. As was pointed out in this column last month, we are not, as yet, involved in a full-scale war; we do have a sizable stockpile of natural rubber, and maybe we should not insist on reducing our consumption of the natural rubber quite so far until we have enough synthetic to replace it.

There are many persons, including the editor of India Rubber World, who cannot see the reason for accumulating such a tremendous stockpile of natural rubber and at such a rapid rate, when the amount on hand at the present time has been shown to be ample for our needs in the event of an all-out war of five or more years' duration. There are also some reasons for believing that this tremendous stockpile of natural rubber is being accumulated so that we will be able to supply the needs of all of our allies in such a war. Many of these allies are now accumulating their own stockpiles.

Furthermore, it is understood that the natural rubber stockpile goal is to a considerable extent predicated on natural rubber content specifications for many products that are now considered unrealistic. The industry is turning out many of these products with lower natural rubber content, and the same product performance is being obtained as was possible when the products had a higher natural rubber content.

On the matter of a fixed-price, fixed-quantity contract between natural rubber producing nations and the United States, we agree with John L. Collyer, president, The B. F. Goodrich Co., who stated recently:

"It is our conviction that the world supply situation is not nearly so serious as has been stated and is improving so rapidly that a much lower price for crude rubber will result within the next few months, provided that our nation is not involved in a war with Russia, our government does not enter into price cartels with crude rubber producing nations or fixed-price arrangements with private producers, and that the adequacy of the nation's crude rubber stockpile, already accumulated, is realized."

The need of an immediate and continuing review at the highest government levels of our national rubber program becomes more and more apparent with each passing month.

R. G. Seaman

DEPARTMENT OF
PLASTICS TECHNOLOGY

Molding and Extrusion of Teflon[1]

David D. James[2]

TEFLON is one of the most unusual plastics developed in recent years. Its outstanding properties have led to its use in fields never before open to plastics. These properties include resistance to high and low temperatures, unusual chemical resistance, excellent electrical qualities, and non-adhesiveness. For example, service temperatures of up to 500° F. are possible with Teflon because only a 10-20% loss in tensile strength has been noted after one month at 570° F. Teflon is resistant to all chemicals except molten alkali metals and fluorine gas under certain conditions. The excellent electrical properties of Teflon are shown by the fact that it maintains a power factor of less than 0.0005 over the entire frequency range now in use, from 60 cycles to 30,000 megacycles.

This paper will discuss the various techniques used to fabricate articles from Teflon. These techniques include molding, screw extrusion of rods and tubes, ram extrusion of rods, and the coating of electrical conductors.

Composition and Available Forms

Teflon is the du Pont trade mark for polytetrafluoroethylene. The plastic is produced in the form of molding powder and in several types of dispersions. The molding powder, white in color, is made up of very small random-shaped particles whose size is in the order of 30-50 mesh.

Newer forms of Teflon consist of stable aqueous dispersions of the polymer. These dispersions are hydrophobic colloids with negatively charged particles and contain small amounts of a wetting agent to increase their stability. They tend to settle if allowed to stand for a long time or if heated to about 160° F., but mild agitation will effect a redispersion. Dispersions of this type have made possible new techniques of coating and impregnating that were previously impossible.

Another form of Teflon, derived from a dispersion, consists of very fine particles mixed with a volatile lubricant. This material looks like the molding powder, but feels slightly wet to the touch and can be squeezed by hand into a smooth thin film. This material can be ram extruded, after which operation the volatile lubricant must be driven off, and the polymer then sintered.

These are the various commercial forms of Teflon. From the molding powder simple shapes can be molded, rods and tubes with heavy walls extruded, and tape as thin as two mills produced. Electrical conductors can be coated by screw extrusion or by several methods employing dispersions. In addition, certain materials can be coated or impregnated by the dispersions.

Teflon products have a wax-like surface and vary in color from chalk white to gray. Parts cooled in the presence of oxygen remain white; while those cooled without oxygen turn gray. This condition accounts for the fact that individual pieces may differ in color, but these color variations do not affect the physical or electrical properties of the plastic.

The Teflon molding powder has a tendency to lump up and to stick to the sides of its container. When pressed together even by hand, the particles stick together to form a lump. Two such lumps cannot usually be joined together because any slippage between the lumps in the plane of the joint orients the powder. Such orientation prevents adhesion in the preform state and causes cracks along this plane after baking. This action of the powder necessitates the use of special techniques in molding and extrusion.

Molding Techniques

The handling of Teflon molding powder is somewhat similar to the techniques used in powder metallurgy. Unlike conventional molding compounds, Teflon does not gradually soften as it is heated,

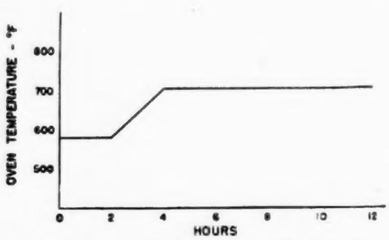


Fig. 2. Sintering Cycle for Thick Teflon Sections

but undergoes a transition from its normal crystalline state to an amorphous gel at 620° F. The material is, therefore, preformed at room temperature, sintered above the gel temperature, and then cooled.

PREFORMING. The preforming operation in which the molding powder is screened into the mold, raked to insure subsequent uniformity of pressure, and then compressed under a pressure of 2,000 psi. is illustrated in Figure 1.

A loader like the one shown can be used to screen the powder quickly and uniformly. Teflon powder is introduced through an opening in the top of the loader, and the hand crank then turned. The blades break up any lumps and force the powder through the screen and into the

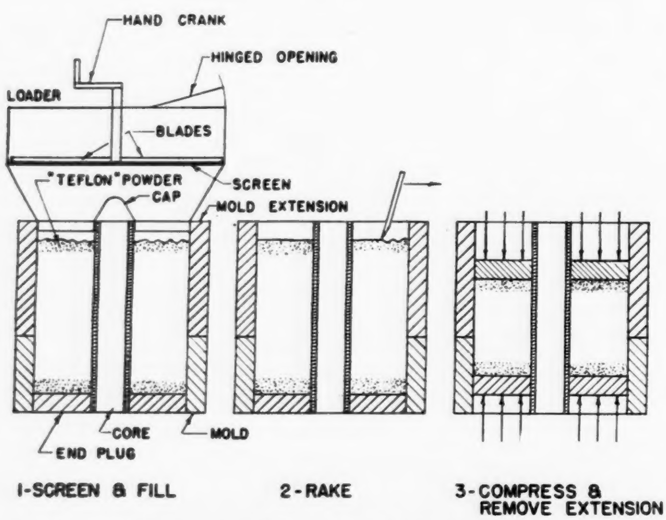


Fig. 1. Diagrammatic View of Teflon Preforming Operations

[1]Presented before National Technical Conference, Society of Plastics Engineers, Inc., New York, N. Y., Jan. 18, 1951.

[2]Product specialist, field service laboratory, polychemicals department, E. I. du Pont de Nemours & Co., Inc., Arlington, N. J.

mold. The mold cap prevents any powder from entering the core. The hollow core permits uniform heat to be applied to the inside and the outside of the Teflon section during the subsequent sintering or fusing of the compressed particles. This core also promotes more uniform cooling of the sintered piece. Thin sections designed with no core usually allow sufficient heat transfer to sinter and cool uniformly.

A weighed charge of molding powder is generally used so that the final piece will be of the proper dimensions. The powder is compressed to one-quarter of its original volume during preforming. This compression ratio makes necessary the use of presses having a sufficient large daylight opening to accommodate the longest piece to be molded. Besides, mold extensions are often required during the initial filling. Initial preforming can be done in one press, and final preforming in a second press, if desired. Once even the slightest amount of preforming has been done, no more powder can be added, or cracks will appear in the finished piece between the initial and added charge of Teflon. In place of preforming, automatic pelleting has been used on some small pieces.

SINTERING. Small pieces made up entirely of thin sections are removed from their molds and sintered at 700° F. for ½ hour to six hours, depending on their size. When a section exceeds two inches, it is left in its mold, heated for two hours at 580° F. to obtain uniform temperature throughout the piece, brought up to sintering temperature during another two-hour period, and then sintered for eight hours at 700° F. (see Figure 2). The end caps on the mold are left free while the mold is in the oven so that the Teflon is free to expand during sintering.

Different treatments after sintering are shown in Figure 3. Sheets and small pieces of Teflon can be cooled under atmospheric pressure. Larger pieces are generally cooled under 2,000 psi. pressure for one hour to five hours while still in the original mold. A water spray is usually applied to the ouside of the mold for several minutes at the start of the cooling cycle. A special press is sometimes desirable for removing the cooled piece from the mold.

Small pieces and sheets are sometimes coined, while still in the gel state, to gain greater accuracy of dimensions. When coining several pieces at the same time, the operator must move them from the oven and line them up in the press very rapidly in order that the coining press will be closed before the Teflon can cool below the gel state. The coining press platens are cored for cold water circulation and cool the pieces in one minute to two minutes while the pressure is being applied. By coining, an accuracy of ±0.015-inch is possible on a diameter of two inches, and ±0.030-inch on a length of 2½ inches. Coining cannot be used to change the shape of the preform more than slightly, and no methods have as yet been developed for providing undercuts or anchoring inserts.

It will be noted in Figure 3 and subsequent illustrations that exhaust ducts are used at all times when Teflon is at an elevated temperature because the material gives off toxic gases when heated near or within the gel range. Very small quantities of fumes are given off at 480° F., but appreciable quantities are emitted when the Teflon is heated above 600° F. These ducts should be connected to an adequate exhaust fan to draw the fumes outside the building. Proper precautions can insure completely safe operating conditions.

Screw Extrusion

Screw extrusion of Teflon powder is unlike the conventional method whereby the plastic is heated as it is conveyed forward by the screw. Teflon must not be subjected to mechanical working while in the gel state, or cracking of the finished piece will result. For this reason the screw is used to compact the Teflon while still cold, and the powder is then forced through a die having a long land in which it is sintered. Die temperatures of 700-800° F. are used, depending on the rate of extrusion.

A typical extruder for producing rods is shown in Figure 4. Note the use of a special-metering hopper to overcome the tendency of the powder to stick and lump. Prebaked molding powder may be used to aid feed in the hopper, since prebaking hardens the powder particles and makes them more free flowing. The extrusion rate is determined by the speed of the metering screw in the hopper. The extruder barrel is grooved at the back in order to obtain a more positive thrust on the powder. The extruder screw is generally operated at a constant speed of about five revolutions per minute.

Dies from 9-36 inches in length can be used, depending on the size of rod being extruded. A brake is often applied to the rod at the exit end of the die to help maintain back pressure. Rods can be extruded in a multiple die, and Figure 4 shows two cavities. Five or six 5/16-inch rods have been extruded at one time, and even three one-inch rods have been produced at a time. A two-inch extruder will produce a maximum of 45 pounds in 24 hours.

Essentially the same method is used to produce Teflon heavy wall tubing, except that a spacer plate is placed between the extruder and the tubing die. This plate contains a circle of holes located on the root circle of the extruder screw and is threaded to hold the mandrel which forms the inside diameter of the tubing. This plate forms a breaker plate through which the compacted powder will pass and reform, and the material is able to re-form without subsequent cracking because practically no slippage occurs in the direction of flow. As in the case of rod extrusion, the Teflon tube is sintered as it is slowly forced through the long land of the die.

Ram Extrusion

Another method used to produce rod, ram extrusion of granular polymer, is shown in Figure 5. Ram extrusion is less expensive to set up than screw extrusion and operates at greater speeds. Since the ram process is a recent development, rods under ½ inch in diameter and tubing have not as yet been made to any extent. Current experimental work, however, indicates that the ram process may soon be considered as versatile as the screw extrusion process. Ram extruded rod is more flexible than screw extruded rod because it is oriented to a lesser degree during production.

In the ram process powder is fed into the hopper, compressed as the ram is advanced by the air cylinder, and sintered as it is driven slowly through the heated die. A plug is used in the die at start-up to maintain back pressure, but wall friction is usually sufficient during operation to maintain this pressure without the need of braking or spring loading of the extruded rod.

A typical ram extrusion cycle consists of the following: (1) the ram is withdrawn for 12 seconds, during which time a charge is metered in by hand or by a vibrating hopper; and (2) the ram is advanced a distance of four inches for 48 seconds under a pressure of 320 psi. Rods 1½ inches in diameter have been produced by this method at a rate of 34 inches per hour, or 19 pounds per hour. One-half and one-inch rods have also been made at even greater linear rates.

It should be noted that the wall thickness of the extrusion die is built up with aluminum tubing to insure uniform heating throughout the length and the periphery of the die. In addition, the larger die diameter permits the use of heater bands of higher wattages to maintain die temperatures of about 725° F.

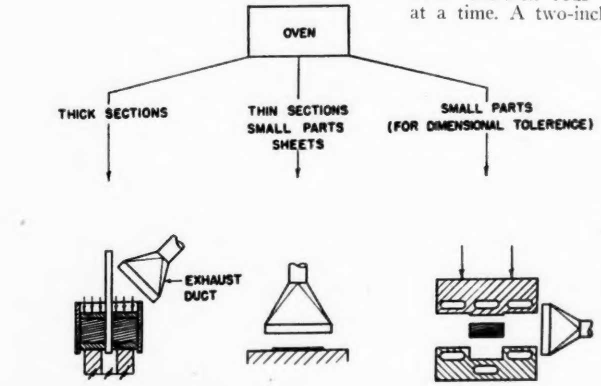


Fig. 3. Post-Sintering Treatments for Teflon Moldings

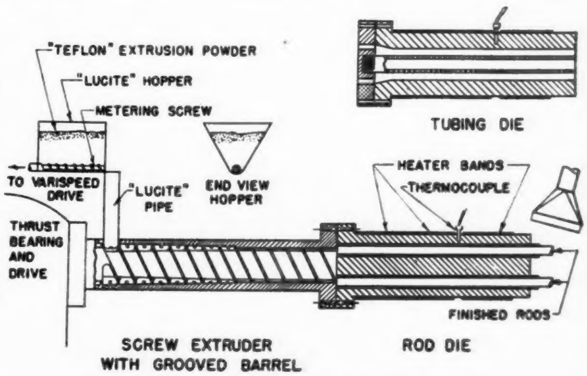


Fig. 4. Diagrammatic View of Screw Extrusion of Teflon Rod and Tube

Coating of Electrical Conductors

The final part of our discussion is concerned with the coating of electrical conductors with Teflon. Three general methods are used, depending on the thickness of the coating. In the first method, coatings less than 10 mils in thickness are applied by multiple dip coating using specially formulated wire enamels based on Teflon dispersions. These dip coatings always require subsequent baking.

In the second method, thicker coatings of 10-60 mils are applied by ram extrusion of a lubricated Teflon powder. This method is new and still under development. Since it appears quite promising for shapes and tubes of small cross-section, as well as for coating wire, we shall describe it in some detail.

A simplified diagram of such a wire coating unit is shown in Figure 6. Lubricated extrusion powder is first screened into the preform cylinder, and the preform then produced by little more than manual pressure on the end plates. A rod is kept in the center of the cylindrical preform in order that the wire may be guided easily through the slug. Two-piece preforms do not appear very practical because, here again, post-sintering cracks may form along the line of the plane between the two slugs. This characteristic also limits the length of wire that can be handled, since the wire must always be broken between preform slugs.

After the preform has been placed into the cylinder the wire is strung through the whole system. The ram is then advanced by the screw press, with ram speeds in the order of inches per hour. The cylinder is not heated in any manner, but local heat is applied to the die in order to give the finished piece a smooth surface. The die temperature should be kept between 140 and 200° F. As the coated wire comes from the die, a micrometer can be used to measure the outside diameter, but care must be taken not to squeeze the coating which is still soft.

The wire then passes through a vaporizing oven where the lubricant is driven off. The vaporizing and sintering ovens are constructed of sections of tubing made from aluminum rod drilled through the center. These tubes have inside diameters of one inch and outside diameters of three inches. The comparatively large outside diameter accommodates heater bands of sufficient wattage to hold the desired temperatures. End caps are generally used when wire is coated in order to restrict the oven entrance and exit. Tubing and shapes of larger outside dimensions than the coated wire are made without end caps.

The temperature used to vaporize the lubricant, usually around 550° F., depends on the wire speed and thickness of the coating. Too low a temperature fails to remove all the lubricant, and it becomes baked into the insulation during the sintering operation, giving a final insulation of inferior electrical and physical properties. Too high a vaporizing temperature causes the coating to start sintering in the first oven, with much the same result. The second or sintering oven is set at about 750° F. No quench bath is used when the wire leaves the ovens, and the wire is taken over draw-off rolls or a capstan to the wind-up.

Horizontal operation of this process has so far been found impracticable, but vertical extrusion both upward and downward is possible. Although the vaporizer should normally be twice the length of the sintering oven, some extruders have been set up with parallel ovens of the same length and separated by a sheave. The Teflon coating will not crack between ovens if a large enough sheave is used.

The wire production rate with this process is limited by the oven lengths rather than by the extruder. The thickness of coating, moreover, is not limited by the extrusion process, but by the ability to remove lubricant without sintering the Teflon. This type of experimental extruder has been capable of coating wire at a rate of five feet per minute, and improved equipment now being built is designed for rates over 15 feet per minute. The maximum length of wire that can be coated depends on the wire diameter and the coating thickness. Equipment now in use is designed for a three- to five-pound charge of lubricated extrusion powder having a Teflon content of about 80%.

Small rods and tubes can also be made by this process, but, as yet, production has been only on an experimental basis. The greatest difficulty encountered is the handling of the Teflon in the ovens, since unbaked material has low tensile strength and vaporized Teflon has even lower strength. The material, therefore, must be supported throughout most of its length, and special care must be taken in passing the material between ovens.

The third and final method for coating wire with Teflon is restricted to heavy coatings and consists of screw extrusion of granular polymer. This method, the oldest one for covering wire, is similar to screw extrusion of rod, which has already been discussed. The die is usually set at a 45-degree angle to the axis of the extruder barrel, and the wire pulled through the die only by the extrusion pressure. As in rod extrusion, the screw compacts the cold polymer until it enters the long land die where it is heated to sintering temperature.

The extruder screw is operated at about 5½ revolutions per minute, but the extrusion rate is again determined by the speed of the hopper screw. Dies more than two feet long are used; consequently very slow extrusion rates are achieved. The maximum production rate to be expected by this method is about six feet per hour.

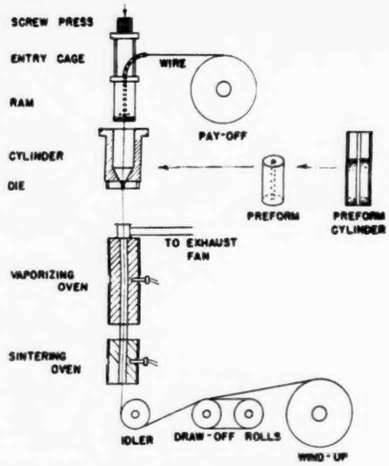


Fig. 6. Diagrammatic View of Wire Coating with Lubricated Teflon Extrusion Powder

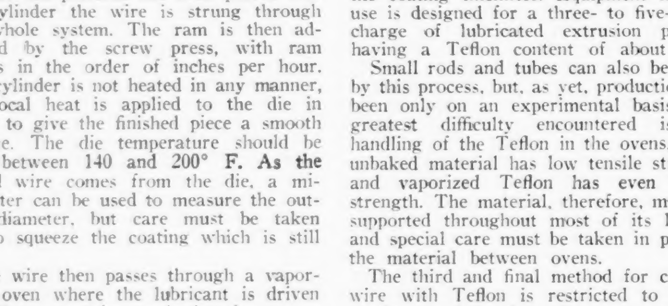


Fig. 5. Diagrammatic View of Ram Extrusion of Teflon Rod

Summary and Conclusions

In reviewing the various techniques we have discussed, it should be apparent that most of the currently recommended methods for molding and extruding Teflon are relatively new. Some methods mentioned are still in the development stage. Great improvements have already been made in methods of handling Teflon, but current work in the du Pont laboratories promises even better methods in the future.

Although fabricating techniques are unusual and production rates relatively slow, the remarkable combination of properties possessed by Teflon has caused a constantly increasing demand for this product. Wire coatings and electrical tape of Teflon have very good temperature resistance and excellent electrical properties even at high frequencies. Chemical resistance has also made Teflon a new and interesting candidate for gaskets, packings, and liners. Breadmaking, dough rolls and heat sealer jaws are examples of Teflon applications where non-adhesiveness is important. These are only a few of the growing list of uses for Teflon, which is rapidly gaining a place as an essential industrial plastic.

Plastics in Defense

REPRESENTATIVES from the Army, Navy, Air Corps, Quartermaster Corps, Bureau of Ships, National Production Authority, and other government agencies met with the Thermosetting Plastics Molders Committee for National Defense, Society of the Plastics Industry, Inc., at a luncheon meeting on February 23 at the Shoreham Hotel, Washington, D. C. N. A. Backscheider, Recto Molded Products, Inc., and J. J. Bachner, Chicago Molded Products Corp, acted as co-chairmen of the meeting, which was held to acquaint government representatives interested in the use of plastics in the defense program with the industry's production capabilities. Representatives from plastics companies all over the country attended to

present the most recent developments in the industry of significance to the defense program.

During the period from 1939 through 1945 the thermoplastics molding industry registered almost a threefold expansion in output. Since then, increased press sizes, use of preheating, and improved molding techniques have placed this branch of the plastics industry in an even better position to produce large quantities of military and essential civilian plastics products. Of the 385 companies engaged in thermosetting molding, 99% have fewer than 500 employes, and 77%, or 291 firms, have less than 200 employes. Production output, however, is very large in relation to number of workers because the thermosetting molding process is highly mechanized, and finishing operations are held to a minimum.

New Hyatt Award Closing Date

A new closing date for nominations for the annual John Wesley Hyatt Award for outstanding achievement in the field of plastics has been announced by William T. Cruse, award committee secretary and executive vice president of the SPI. The formal closing date of April 2 has been extended to April 30. In announcing the change, Mr. Cruse said that the committee considered current conditions in the plastics industry where many nominations have doubtlessly been delayed by the pressure of added work.

The Award, established 10 years ago by Hercules Powder Co. to honor Hyatt, discoverer of the first plastics material, consists of a gold medal and $1,000. The competition is open to molders, fabricators, laminators, extruders, reinforced plastics processors, film and sheeting producers and printers, machinery and equipment manufacturers, and raw material producers. Entry blanks may be obtained from Mr. Cruse, SPI, 295 Madison Ave., New York 17, N. Y.

For More Styrene

PLANS to increase substantially the capacity of its new styrene plastic plant at Long Beach, Calif., have been announced by Monsanto Chemical Co., St. Louis, Mo. According to Irving C. Smith, general manager of the company's western division, expansion work is now under way at the plant, which was opened last August. The expansion will permit more than 100% increase in production capacity and allow Monsanto better to serve the fast growing West Coast plastics industry. Lack of available raw material for the manufacture of styrene may not permit a full doubling of production at the outset, Mr. Smith said. Installation of the new equipment is expected to be completed in July.

Offers New Plasticizer

Ortho-nitrobiphenyl, a low-cost primary plasticizer compatible with a wide range of materials, is now available in quantity from Monsanto. Most natural and synthetic resins may be plasticized with ONB, and the product is suggested as a possible replacement for many plasticizers in short supply because of raw material scarcities. ONB is said to be compatible with cellulose esters and ethers, polyvinyl chloride, polystyrene, polyvinyl butyral, polyvinyl acetate, rosin and rosin esters, modified phenolic resins, alkyd resins, and vegetable oils. The material is particularly recommended for use with polyvinyl acetate adhesives, as a low-cost primary plasticizer for polyvinyl chloride, and as a plasticizer for cellulose nitrate and cellulose acetate. In nitrocellulose ONB may be substituted for all or part of the camphor used because of its similar and, in some cases, superior plasticizing action. Since ONB has a fungicidal effect, formulations containing it are not attacked by microorganisms.

SPE Sections Meet on Plastics Problems

A PANEL discussion on plastics made and distributed by United States Rubber Co. featured the March 14 semi-annual joint dinner-meeting of the New York and Newark Sections, Society of Plastics Engineers held at the Military Park Hotel, Newark, N. J., with some 80 members and guests of the two groups attending. Panel speakers, all from the rubber company's Naugatuck Chemical Division, were George R. Vila, Earle S. Ebers, and Willard de C. Crater.

Mr. Vila began the discussion with a brief review of the organization of U. S. Rubber, the plastics made or distributed by the company's various divisions, and the relations between the different plastics. The speaker noted that U. S. Rubber was in polystyrene work during the early 1930's and has now returned to this field with its styrene-monomer combinations. Plastics made or marketed by the different company divisions are as follows: footwear and general sundries division, Royalite, SatUSply, and Naugahyde; mechanical goods division, Uscolite and Enrup; and Naugatuck division, Marvinol, Kralastic, Vibrin, and Kotol.

Dr. Ebers discussed the properties and uses of Royalite, Uscolite, Kralastic, Enrup, and Vibrin, using many samples to illustrate his talk. Royalite, available in sheet form provides toughness, decoration, easy forming, stain resistance, good electrical properties, and chemical resistance. Uscolite, the name applied to molded plastics made by the mechanical goods division, has toughness, chemical resistance, and low moisture absorption. Kralastic molding powder, based on Kralac resins, gives parts having rigidity, toughness, dimensional stability, low gravity, chemical resistance, and good electrical properties. Enrup thermoset molded goods, available in a range from flexible to rigid materials, provide toughness, chemical resistance, and abrasion resistance. Vibrin polyester resins are liquids that provide cures without porosity, 100% reactivity, a hardness range from flexible to rigid materials, full color range, chemical resistance, and good electrical properties.

Mr. Crater dealt with the properties and uses of Marvinol vinyl plastics, with particular reference to the new rigid Marvinols. Most of the early work on rigid, unplasticized vinyls was done in Germany where these high molecular weight resins were extruded on twin-screw machines at very low production rates. Despite the high molecular weight of the rigid Marvinols, they can be extruded on either single- or twin-screw machines at good production. Another relatively new development in the vinyl field is the manufacture of expanded vinyl which is nonflammable, in addition to possessing the other valuable properties of vinyl resins. The speaker noted that expanded vinyls are finding wide application in military aircraft and other defense uses.

Newark Section President Peter W. Simmons, Dow Chemical Co., presided over the meeting and welcomed the New York delegation. New York President George Baron, Ideal Plastics Corp., also spoke briefly on future programs of the group. Table favors were distributed to all attending the meeting through the courtesy of Vulcanized Rubber & Plastics Co.

Military Use of Plastics

The Cleveland-Akron Section held its first regular dinner-meeting of the year on January 29 at the Garden Grille, Akron, O. Speaker of the evening was Charles N. Gardner, associate research director, Office of the Quartermaster General, who discussed "Plastic Trends in the Armed Forces."

Mr. Gardner stated that military uses of plastics to date have been largely as substitutes for other materials. Serviceability requirements are such that many thermoplastics are unsuitable because they are too soft at high temperatures, extremely brittle at low temperatures, and incapable of withstanding misapplication abuse in field usage. Polyethylene is on short supply and in great demand for wire and cable insulation. The problem with vinyl resins and films is one of tailoring products to military specifications, and vinyl film uses are limited at present to such items as rifle covers, bags, etc. Vinyl coatings for fabrics are being used in increasing volume in such products as ponchos and portable shelters. The greatest military interest in plastics is in reinforced materials, especially polyester-glass film laminates. Other reinforced plastics based on nylon, Fortisan, Orlon, and Fiber V are also finding increased usage in such items as arctic sleds, skis, field cases, desks, boats, landing mats, housings, etc.

New officers for 1951 of the Cleveland-Akron Section are as follows; president, Wayne F. Anderson, B. F. Goodrich Chemical Co.; vice president, Frank A Martin, Hoover Co.; secretary, David J. Sloane, Lester Engineering Co.; treasurer, Bernard Wulf, Plastic Engineering, Inc.; and national director, George E. Field, also of Goodrich Chemical. Additions to the Section's board of directors for 1951 are Hugh Winn, Firestone Tire & Rubber Co., Stephen Hiltebrant, General Industries Co., and Messrs. Wulf and Martin.

Fiberglas-Resin Laminates

Some 65 members and guests of the Western New England Section attended a regular dinner-meeting on February 7 at the Hotel Sheraton, Springfield, Mass. Subject of the meeting was the use of polyester resins and Fiberglas in low-pressure moldings and laminates, with the use of resins being discussed by Jack D. Robinson, American Cyanamid Co., and the use of Fiberglas treated by William F. Condon, Owens-Corning Fiberglas Co.

Dr. Robinson described the initiation and the growth of the field of low-pressure molding and contact laminating. The polyester-glass combination has high impact resistance and is also corrosion and chemical resistant. A wide range of resin viscosities is available, from 3-1,800 poises, and modified resins can also be supplied, including self-extinguishing and

flexible types. In the forming of polyester-glass parts, the lay-up of the laminate may be by simple contact or by pressure on a rubber blanket. Matched metal molds make the best parts, and the resin is generally poured into the mold and forced throughout the preform by plunger pressure. Glass reinforced molding compounds are also being used for transfer moldings, and parts weighing 23 pounds have been made by this method.

Mr. Condon considered the manufacture of glass filaments and fibers, using a film to illustrate his talk. A recently introduced unit which supplies chopped glass fibers directly from roving was described. The speaker showed a large number of molded and laminated samples to illustrate progress made in the consumer goods field. In the discussion following the talks, two points were emphasized: (1) the wetting of the glass fibers with resin presents a problem, and the best method appears to be flushing the liquid resin through the fibers to remove air; and (2) the gelled resin-glass shape must be kept under continual pressure during molding to compensate for shrinkage.

Molding and Extruding Teflon

The March 1 dinner meeting of the Miami Valley Section, held at the Peerless Pantry, Miamisburg, O., featured a talk on "Molding and Extrusion of Teflon' by David D. James, E. I. du Pont de Nemours & Co., Inc. Mr. James' paper, published in full in this issue, covers the properties of Teflon and the methods used in processing and fabricating the plastics.

Following the talk, reports were heard from National Secretary Walter F. Oelman,, Standard Molding Corp.; and Byron W. Nelson, National Cash Register Co., who is Section Vice President and also chairman of the national committee on professional activities.

Two Speakers at Newark Meeting

A talk by J. L. Morrison, Detroit Mold Engineering Co., on "Mold Polishing,' and a paper on "Military Applications of Plastics" by Charles N. Gardner, Office of the Quartermaster General, featured the February 14 session of the Newark Section. The meeting, held at the Military Park Hotel, Newark, N. J., was attended by about 80 members and guests and included a cocktail hour and dinner.

Mr. Morrison dealt with cavity polishing and said that in many cases the number of hours spent on polishing equalled the hours required for machining the cavity. The polishing operation is not one which can be performed by any tool maker without specialized experience. The speaker expressed the opinion that burnishing rather than polishing is responsible for pitting cavity surfaces by breaking out particles of manganese sulfide from the steel matrix. Good polishing results are obtained by liquid honing after heat treatment.

Mr. Gardner's talk was similar to that which he gave before the Cleveland-Akron Section meeting on January 29, reported elsewhere in these columns.

The business session preceding the talks was featured by the announcement of the appointment of Arthur J. Warner, Federal Telecommunications, Inc., and Section member, as national SPE representative on the International Committee for Standardization of Plastics. The meeting closed with a drawing for a door prize contributed by Koppers Co. through E. Kirby Preston.

Symposium on Information Labeling

A symposium on "Informative Labeling of Plastics Products" highlighted the February 14 joint dinner-meeting of the Chicago Section, SPE, and Midwest Chapter, SPI, held at the Builder's Club, Chicago, Ill. Some 80 members and guests heard the discussion by Phillip A. Belk, Hercules Powder Co., Ralph David, *Plastics Industry*, and Edmund D. Kennedy, Monsanto Chemical Co.

The three speakers reviewed the work of the SPI committee on informative labeling. The basic information required by consumers covers quality, price, and service. The rules for a good label suggested by the SPI committee are: (1) tell what it is; (2) tell what it does; (3) tell what it is made of; (4) tell how it is made; (5) tell how to take care of it; and (6) tell its limitations. The speakers dealt with the design of good labels by showing actual examples of labels used on products and emphasized that the cautions on how to use a product can be worked in successfully on a label without detracting from a sale.

Prior to the regular program, William T. Cruse, SPI executive vice president, spoke briefly on the recent appearance of SPI members before the Senate Committee on Small Business and the efforts being made to alleviate the supply problem in the plastics industry.

Announcement was made of the election of new 1951 officers for the two groups. The new officers of the SPE Chicago Section are: president, Lee J. Swift, H. Muehlstein & Co.; vice president and secretary, Stanley Peters, Monsanto Chemical Co.; and treasurer, Morrie Meltzer, Service Plastics Co. New officers of the SPI Midwest Chapter are: chairman, Ben W. Rau, G. Felsenthal & Sons, Inc.; vice chairman, Earl R. Keown, Santay Corp.; and secretary-treasurer, Wm. H. Snow, Snow Plastics Corp.

CALENDAR

Apr.	17-20.	National Packaging Exposition. Auditorium, Atlantic City, N. J.
Apr.	18.	New York Section, SPE. Hotel Shelburne, New York, N. Y.
Apr.	19.	Quebec Rubber & Plastics Group; SPE; and SPI. Combined Meeting. Queen's Hotel, Montreal, P.Q., Canada.
Apr.	20.	Chicago Rubber Group. Morrison Hotel, Chicago, Ill.
Apr.	24.	Washington Rubber Group.
Apr.	26-28.	APS, High Polymer Physics. Washington, D. C.
Apr. May	30-4.	Fourth National Materials, Handling Exposition. International Amphitheatre, Chicago, Ill.
May	1.	The Los Angeles Rubber Group, Inc. Hotel Mayfair, Los Angeles, Calif.
May	9.	Newark Section, SPE. Military Park Hotel, Newark, N. J.
		Chicago Section, SPE, and Midwest Chapter, SPI. Builder's Club, Chicago, Ill.
May	11.	Philadelphia Rubber Group. Poor Richard Club, Philadelphia, Pa.
May	16.	New York Section, SPE. Hotel Shelburne, New York, N. Y.
May	22.	Washington Rubber Group.
May	24-25.	Society of the Plastics Industry. Greenbrier Hotel, White Sulphur Springs, W. Va.
		Canadian High Polymer Forum. Royal Military College, Kingston, Ont., Canada.
June	3-6.	National Association of Purchasing Agents. Waldorf-Astoria Hotel, New York, N. Y.
June	5.	The Los Angeles Rubber Group, Inc., Hotel Mayfair, Los Angeles, Calif.
June	14.	New York Rubber Group. Annual Outing. Doerr's Grove, Millburn, N. J.
		Rubber & Plastics Division, ASME. Royal York Hotel, Toronto, Ont., Canada.
June	15.	Akron Rubber Group.
		Boston Rubber Group.
		Rubber Chemistry Division, C.I.C. Walper House Hotel, Kitchener, Ont., Canada.
June	18-22.	American Society for Testing Materials. Annual Meeting. Atlantic City, N. J.
June	23.	Southern Ohio Rubber Group. Outing.
Aug.	7.	New York Rubber Group. Golf Tournament, Baltusrol Golf Club, Springfield N. J.
Aug.	24.	Philadelphia Rubber Group. Annual Outing. Cedarbrook Country Club, Philadelphia, Pa.

Injection Molding Aids

"New Production Tools for the Injection Molder," was the topic of A. R. Morse, Injection Molders Supply Co., at the February 12 dinner-meeting of the Upper Midwest Section, held at Esslinger's Cafe, St. Paul, Minn. Mr. Morse's talk was similar to that which he gave before the January 10 meeting of the SPE Newark Section.[1] An added attraction at the February 12 meeting was the showing of three films, "Canadian Cruise," "Canoe Country," and "Famous Fish I Have Met," by Jerome Formo, Minneapolis-Honeywell Regulator Co.

During the business session Section President Paul W. Felt, Brown & Bigelow, Inc., announced the appointment of the following committee chairmen: finance, Secretary-Treasurer Wm. Mahle, Northwest Plastics, Inc.; membership, A. G. Morrison; credentials, Fulton Holtby, University of Minnesota; and program, Mr. Formo.

[1] See our Mar., 1951 issue, p. 697.

International Symposium on Abrasion and Wear

THE Rubber-Stichting, Delft, Holland, is organizing an International Symposium on Abrasion and Wear in order to celebrate the opening of its new building in November, 1951. The first day of the symposium will cover the general aspects of abrasion and wear, including the problems connected with friction and lubrication. The second day, devoted to application, will cover abrasion and wear of metals, plastics, rubber, and other materials. The symposium will have an international flavor, with papers presented in English and French by scientists from various countries. Admittance to the symposium will be free of charge, and interested persons are requested to apply to the secretary in order to be kept informed of developments. The organizing committee consists of R. Houwink, president, and H. C. J. de Decker, secretary, P. O. Box 66, Delft, Holland.

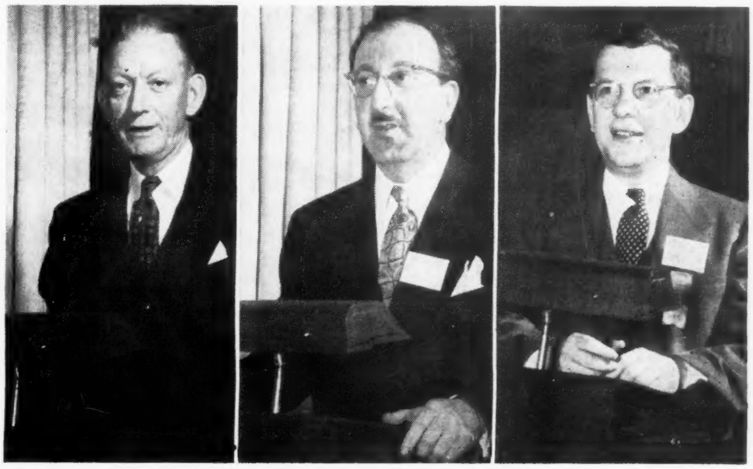
Scientific and Technical Activities

Talks by Government Officials Feature Rubber Division Meeting

ONE of the highlights of the fifty-eighth meeting of the Division of Rubber Chemistry, A. C. S., held in Washington, D. C., at the Hotel Shoreham, February 28, March 1 and 2, was the symposium on "Current Rubber Problems." This symposium, which took place on Thursday afternoon, March 1, consisted of talks by Everett G. Holt, assistant chief, Rubber Division, National Production Authority; Arthur Wolff, formerly chief, Rubber Division, National Security Resources Board, now an official of the Defense Production Administration; and Warren G. Stubblebine, research director, Chemistry and Plastics Section, Office of the Quartermaster General.

In addition to the regular technical sessions which began on the afternoon of February 28, continued on the morning of March 1, and concluded with the morning and the afternoon sessions on March 2, a luncheon-meeting of the 25-Year Club was held February 28; the business meeting was held the morning of March 1, and the Division banquet the evening of the same day.

J. H. Fielding, Armstrong Rubber Co., Division chairman, presided over all these events except the meeting of the 25-Year Club. Registration for the Division meeting was 670, and about 600 were present at the Division banquet. Norman Bekkedahl, National Bureau of Standards, was chairman of the local committee on arrangements.



Speakers at the Symposium on Current Rubber Problems: *(Left to Right)* Everett G. Holt, Arthur Wolff, and Warren G. Stubblebine

The Technical Sessions

In opening the meeting on the afternoon of February 28, Chairman Fielding called attention to the short time interval between the last meeting of the Division in Cleveland last October and the Washington meeting and complimented the officers and authors for their performance in completing the arrangements for the meeting on time. He also paid tribute to the work of the local committee on arrangements and made special mention of the symposium program for the afternoon of March 1.

Abstracts of the papers given at the technical sessions were published in our February issue, beginning on page 575, and no attempt will be made to review these papers further at this time.

The Symposium Program

E. G. Holt, the first speaker for the symposium, spoke on "The Government Rubber Program." He emphasized first that the national policy in rubber had one principal aim — the provision of ample supplies of finished rubber goods for the use of the American public at reasonable prices. An anti-monopolistic policy was pursued both in the domestic and the international fields. We encouraged the use of reclaimed rubber, the production of natural rubber in areas free of production control schemes; we gave particular attention to developments in the Western Hemisphere as a measure of hemispheric defense, and we experimented with the production of guayule rubber for the same reason, Mr. Holt said.

The production and use of synthetic rubber by our government during and since World War II fits into this program. We still need natural rubber; we learned in World War II that the principal sources of supply were vulnerable to attack, and our policy since then provides for strategic stockpiling of enough natural rubber to carry us through any further period of interruption of supplies from the Far East.

Our declared policy is for operation of business by private enterprise, but we have in recent years, tempered this policy, in respect to the synthetic rubber industry, by considerations of national security.

None of us is an entirely free agent, Mr. Holt declared. Our government's rubber policy has to be conducted within a framework of international circumstances that do not leave it complete freedom of action. The postwar situation with respect to world supplies of rubber was summarized as follows:

1. The world annual production of natural rubber has been less than the world annual consumption of new rubber.
2. Restoration of world trade stocks of natural rubber increased the discrepancy between supply of natural and demand for new rubber.
3. Strategic stockpiling of natural rubber by various governments and particularly by our government still further widened the gap between supply and demand.
4. Foreign countries use mostly natural rubber, little synthetic except in Russia and Canada. The requirements of any single foreign country are small compared with our purchases, and for their individually smaller amounts each can outbid us at any price level.
5. The United States imports of natural rubber represent the amount of natural rubber production left after foreign demand has been satisfied.
6. The U. S. manufacturing industry uses what is left of the imports of natural rubber after U. S. Government strategic stockpiling has been satisfied. This residue has been much less than the manufacturers consumption of new rubber.
7. The U. S. manufacturing industry uses as much synthetic rubber as is necessary to balance supply with demand.

This last general statement would apply to the situation in 1950, or today, just as much as in the other postwar years, but with one difference. In other years there was always enough synthetic rubber to enable our industry to use as much new rubber as it desired, but in 1950 and just at present the amount of synthetic rubber was and is not large enough. The well-known reasons for this situation were described by Mr. Holt, who then also reviewed the extremely high consumption of rubber in 1950, in large part due to war fears.

The war in Korea in 1950 led to a reexamination of our stockpiling program for natural rubber, and it was immediately clear both to government men and to industry that consumption of rubber would have to be curtailed in order to permit increased strategic stockpiling. The desire to restore orderliness and more reasonable prices in the rubber market was an additional, but secondary consideration, it was said.

The actions of the Department of Commerce in issuing regulations in the latter half of 1950 and up to the present time were also reviewed, and then Mr. Holt said that NPA had recently found it necessary to make a thorough review of adjustments and allocations of rubber.

This review, begun in mid-January, has now been completed, and all companies have been notified of their new base period, recommended by the Rubber Industry Advisory Committee and accepted by the NPA, as the 12 months ended June 30, 1950. The new base period for the entire industry exceeds the actual consumption of new rubber in the base period by only a small percentage, Mr. Holt added.

Definite standards — NPA standards which apply to other industries as well as rubber — were established and followed

in this reappraisal and will be followed in the consideration of any future appeals. In this connection it was pointed out that when the total consumption of rubber is curtailed within definite limits, any additional allowance to one firm must be at the expense of all others in the industry and is therefore not to be lightly granted.

A second tremendous task was accomplished in February, Mr. Holt said, this time with the aid of 300 industry men organized in task groups. Specifications limiting the use of natural rubber have been developed for all branches of the industry and would be actually implemented by March 15.

With regard to allocations, cutbacks such as were made in December and January are believed to be a thing of the past. The March 1 NPA Order says that each manufacturer can use 48% as much dry natural rubber as in his new base average month, and 95% as much total new rubber, excluding natural latex. After subtracting this amount of natural rubber from the total permitted new rubber, and subtracting the Butyl allocation, if any, and allowing for the use of neoprene and nitrile-type rubbers, the balance represents the GR-S each company is entitled to use. This balance, less any Canadian S-type rubber obtained, is the amount of GR-S allocated to each company.

In connection with natural rubber, it would be helpful if the rubber goods manufacturers would use the types and grades produced by smallholders and remillers to the full extent possible as this practice would aid the stockpiling of estate grades by the government, Mr. Holt explained. Whenever this can be done, manufacturers will find it highly economical because of the wide differential in prices that already exists.

The rubber control order treats natural latex as a separate material, distinct from dry forms of natural rubber, and its use is less restricted than the use of dry natural rubber. During the remaining three quarters of 1951, however, the supplies available for use will probably average 20% less than at present because certain large estates are converting part of their output from latex to dry rubber. The tonnage of latex for consumption will remain larger than the quantity used during the base period, it was pointed out.

The NPA Rubber Division will keep books with a daily balance sheet to be sure that the overall limits on use of natural rubber, and the overall quantities of GR-S and Butyl available for consumption, are not exceeded. Within a month or two a satisfactory pattern of allocation for each company, within the total limits of available materials, will have been worked out.

During the first quarter of 1951 about 260,000 tons of new rubber were available for civilian rubber products in this country. During the remainder of 1951, although more synthetic rubber will be available, there will be less natural rubber, and there will be a rising rate of government orders. Probably the quarterly rate of rubber available for civilian goods will not alter much, declared Mr. Holt. For the year as a whole, there will be more new rubber for civilian use, in the absence of a general war, than was used for all purposes in 1949. The rubber program is part of the general preparedness program, an element of protection of the home and the family of each citizen, and as such it deserves the utmost cooperation, he added.

Mr. Holt said that personally he thought the price of natural rubber was past its peak and that lower prices are in store. Much, of course, depends on the buying policy followed by the government. The high prices for natural rubber have stimulated its production greatly in the native rubber areas of the Far East, and the largest single market is the United States.

"We in the rubber industry must always bear in mind that our industry is subject to swift changes; that the unexpected is prone to happen. I venture an opinion that the restrictions on total use of rubber which may today seem an imposition may, in retrospect, assuming no general war, prove to have been in the best interest of economic stability in the industry, and that when limitations are lifted, the industry will have a larger market for its products than if unlimited consumption had continued," Mr. Holt said in conclusion.

Arthur Wolff, the next speaker, discussed "Preparedness in Rubber." He first reviewed the organization of the NSRB and mentioned that the first meeting of the Board, attended by five Cabinet members, was held in November, 1947, and one of the three items on the agenda for that meeting was "A National Rubber Policy."

Early in 1948 we started crystallizing our thoughts on a mobilization plan for the rubber industry, Mr. Wolff said, and our approach was to try to obtain the answers to two questions:

1. Do we have the capacity to produce the rubber items needed by the military services and the war supporting civilian economy during an all-out five-year war period?

2. Do we have the raw materials to sustain the necessary rate of production during an all-out five-year war emergency?

In the first task of determining the requirements for rubber products and matching these requirements against our national production capacity, the advice of the rubber goods manufacturing industry was obtained. There was general agreement that tires should be taken as an indicator item, and a complete study done on this one item so as to simplify the task. If time permitted, additional segments of the rubber industry, such as wire and cable, rubber footwear, mechanical goods, etc., could be covered. Since fairly accurate factor relations are available on the distribution of rubber consumption between tires and other rubber products, the study would provide fairly accurate information on rubber requirements.

On the requirements side, the Munitions Board was requested to supply military and Defense Aid tire requirements, and the Office of Transportation of the NSRB was requested to supply essential civilian tire requirements. Since it was planned to review and revise the study annually, the requirements were based on a hypothetical war emergency starting on January 1, 1951, Mr. Wolff explained.

The task force, after much thought and study, devised a system whereby all 25 tire producers requested to supply unit tire capacities could report their capacities on a common basis. Even more important was the development of a system of factors which allow a quick calculation of the change in capacities resulting from a change in the tire production pattern. Devising the procedures to be used, assembling the information, performing the necessary calculations, and writing the report took almost 18 months. Future revisions should take only about 30 days.

The NSRB-Munitions Board Rubber Industry Advisory Committee endorsed the report and recommended it be reviewed and revised annually. The report revealed three conditions that required corrective actions, and the Munitions Board has already taken the necessary action of centralizing procurement of tires, standardizing tire sizes, and providing additional military molds.

On the raw material requirements side, the tire requirements were used to develop estimates of rubber, carbon black, processing chemicals, and synthetic rubber feedstock requirements. Little need be said on the details of these studies other than that these studies exist, conditions have been exposed that required corrective action, and that for the most part remedial action has been either taken or is under way or is under study, this speaker said.

He then compared our present rubber position with our pre-World War II position and emphasized that we now have a proven synthetic rubber industry capable of supplying more than 1,000,000 long tons of rubber a year, and that by June of this year the rate of production in both government and private plants will be more than 900,000 tons a year.

We know that the material we can produce is in many applications equal to or better than natural rubber, and we also know that synthetic rubber can be used to make adequate rubber products for at least 80% of our total requirements, and this percentage can be further reduced. The ratio during World War II went to 87% synthetic and 13% natural, but this resulted in some degradation of product and was wasteful of manpower and materials.

It was said that the answer to the question, "Is this enough?" could not be answered categorically by "Yes" or "No." On the basis of presently available information, we believe the present synthetic rubber production capacity is ample, Mr. Wolff declared. If, however, we are wrong, the magnitude of the job required to expand synthetic rubber capacity by 100,000 or 200,000 tons is a comparatively small one as compared with the 1941 job of starting a new industry "from scratch." Detailed plans for such an expansion of synthetic rubber production capacity are also now being completed.

If we are to have the best possible products, we should have some natural rubber to go along with our synthetic, and the natural rubber is being provided for by our stockpiling program, which has been in existence since the passage of the Stockpiling Act in 1946.

Further improvement in our present rubber position is up to the research people and technicians of the rubber and allied industries, it was stated. If we assume that at present we need 80% synthetic and 20% natural to make good rubber products, an increase in synthetic usage by only 10% would decrease our stockpiling requirement for natural rubber by 50%. At present rubber prices this means a dollar saving that can be measured in the hundreds of millions of dollars.

From a national security point of view, as our dependence on natural rubber decreases, our independence in rubber increases, said Mr. Wolff, who concluded with the thought that this should provide a challenge for the rubber chemists and technicians.

Warren Stubblebine, the final speaker on the symposium program, discussed "Army Needs for Rubber-Like Materials." All materials for Army use must function under conditions of use that may vary from the tropics to the Arctic, and stor-

age that may take place under a tarpaulin in direct sunlight or in an unheated tent or warehouse in the Arctic.

The basic temperature requirements for ground use items have been in operation at temperatures as low as —65° F. and as high as 130° F., and storage at temperatures as low as —80° F. and as high as 160° F.

Besides temperature requirements, each specific item must possess certain necessary qualities to insure proper functioning, and no broad rules can be followed in this case—each is a law unto itself, Mr. Stubblebine declared.

The speaker covered six classes or groups of items which present similar or related problems and used these in an effort to summarize some of the individual requirements.

1. Tires and Tubes. In the case of tires and tubes it is only the low temperature requirements which have not been met adequately. Although one special polymer for tires and tubes had excellent properties at low temperatures, under road test conditions in Texas the tread wear was excessive.

Superimposed upon the low temperature requirement is the very real problem of replacement of natural rubber in large-size tires which has not been answered although some progress has been made.

Butyl rubber tubes have performed satisfactorily under the conditions of use, and little or no problem exists in this field.

2. Seals and Gaskets. Because of the wide variety of very specific and very detailed applications of seals and gaskets, it is difficult to present a summary with any significance. The liquids which they are required to seal cover the range of lubricating oils, aromatic and non-aromatic fuels, hydraulic liquids, etc.

Low compression set, resistance to the specific liquid with which it is in contact, and retention of flexibility (non-stiffening) are the prime requirements for seals and gaskets.

Most of these applications require the use of nitrile-type rubbers, neoprene, or "Thiokol," and each has its deficiences. By compounding, redesign, and careful choice of the specific material it has been possible to make some improvements along these lines, but progress in the field of oil-resistant polymers for low temperature use has been slower than that in the non-oil-resistant field.

3. Coated Fabrics. In general the problems of rubber coated fabrics are not so serious as those in other fields since for many general uses, not requiring oil or solvent resistance, plasticized vinyl coatings are available to meet many of the requirements.

The adhesion of rubber to nylon is one of our prime interests. Because of the weigh-strength factor of nylon fabrics it would be highly desirable to use nylon rather than cotton for many purposes, particularly for lightweight coatings.

Coated fabrics for inflflatable items present problems of permeability, ease of cementing, outdoor exposure resistance, and resistance to snagging and puncture. If we include problems with respect to fuel cells of all types, then we add the problems of oil resistance, barrier layers, and, in some cases, self-sealing characteristics. There is also the continuing problem of the poor low-temperature properties of the oil resistant rubbers.

4. Insulation and Tape. In this field the trend toward lightness in weight and improved low temperature performance has brought about a changeover from rubber to other materials, such as polyethylene. These materials are required to provide the best in insulation with the minimum in size and weight, and the winterization program calls for performance at low temperatures.

Potting compounds which are used for sealing up assemblies or sub-assemblies are especially important because it is necessary that these compounds permit dipping of the part or pouring into the sub-assembly. Good insulation, ease of handling, resistance to high temperature in some applications, and again maintenance of functional properties at low temperatures are important factors that must be considered.

5. Hose and Belting. The problems of hose are those associated with oil-resistant materials in each specific application and that of low temperature use. Some work being done in the field of non-extractable plasticizers offers one of the most promising leads in connection with low temperature service.

6. Miscellaneous. There are many other items in which rubber presents some special problem, such as in adhesives, sponge, footwear, etc., but if answers are found to the problems already cited, their application in the remaining fields is not too difficult, Mr. Stubblebine stated.

He then presented a summary report of the work in progress aimed at solving some of these above-mentioned material deficiencies.

In the field of non-oil-resistant polymers, after three years of work it is now known that the following four are the best available, and it is doubtful that further research will make but minor improvements. These four polymers are: 95/5 butadiene-styrene polymerized at 122° F.; 90/10 Bu-Sty polymerized at 41° F.; 85/15 Bu-Sty polymerized at 122° F.; and 80/10/10 butadiene-styrene-isoprene polymerized at 41° F. The fact should be noted that the best properties are obtained by blends of the above polymers and by blending any of these materials with standard GR-S. In this way a non-crystallizing stock can be produced.

All of the above four polymers have good low-temperature properties without great sacrifice of properties at normal temperatures, except when used for tires. Tread wear at normal temperatures has been shown by fleet tests to be inferior with these polymers.

In all other fields, save a few, any or all of the four polymers fulfill the requirements for non-oil-resistant rubbers for military use. There does not appear to be sufficient difference between these polymers and standard GR-S to warrant any large-scale work or concern. Long-term storage data and outdoor exposure data on these low temperature polymers is being obtained. Mr. Stubblebine said that help from industry in learning more about the compounding and fabricating properties of these polymers would be welcomed by the Army.

In the field of oil-resistant polymers and special polymers, no particular progress could be reported, but work was in progress on "Thiokols," the fluorocarbons, hydrogenated butadiene and some copolymers, the silicones and new types of nitrogen compounds. "Thiokol" ST polymers with a 20° F. improvement in low temperature serviceability have been made. Rubber fluorocarbons with good low-temperature flexibility can be made, but other properties of such polymers are at present unknown.

It has been found that hydrogenation of polybutadiene and some of its copolymers improve the low temperature properties and the oil resistance of the basic polymer, but it likewise produces materials which are borderline between plastic and rubbery. This type of polymer may find use in gaskets and seals, hose, tapes, etc., where rubberiness as such is actually secondary.

On silicone rubbers, the work has been restricted to a study of the nature of reinforcing agents. If silicones could be reinforced in the same manner as other synthetic rubbers, they would find much wider application by virtue of the higher tensile strengths, greater abrasion resistance, and general improvement in overall properties. A great deal of work has been done on this problem, and there are indications that the properties of silicones can be improved by the reinforcing agents.

All that is needed as a result of this work on improved polymers is a rubber with the low temperature performance of the silicones, the oil resistance of "Thiokol" or neoprene, the workability and general properties of natural rubber, and the availability of GR-S, the speaker said.

The copolymerization of butadiene with nitrogen compounds other than acrylonitrile is also being investigated in an effort to improve the low temperature properties of nitrile type rubbers without loss of oil resistance.

In conclusion, Mr. Stubblebine said that the problem of oil-resistant rubber with good low-temperature properties was being attacked from all possible angles, including sulfur, fluorine, silicone, nitrogen polymers and copolymers, and by the hydrogenation of some of these polymers, but that the Army would welcome suggestions on any other possible line of approach.

25-Year Club Meeting

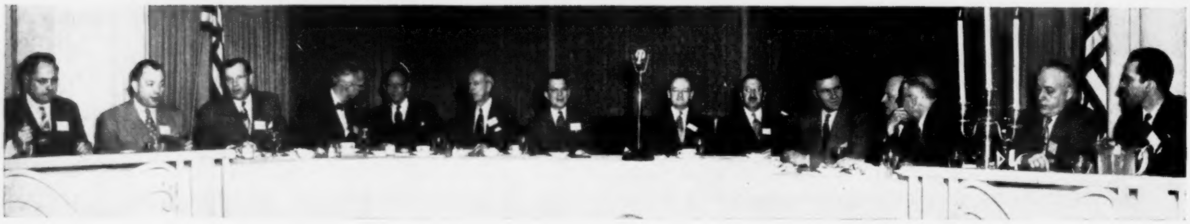
The luncheon meeting of the Division's 25-Year Club on February 28 had an attendance of about 125 and was presided over by Ernest R. Bridgwater, E. I. du Pont de Nemours & Co., Inc., who first paid tribute to Harry L. Fisher, National Research Council, the co-chairman and the man who had "done most of the work in connection with the meeting."

New members, i.e., Division members who recently completed 25 years' association with the rubber industry, were next introduced, including Amos Oakleaf, Phillips Chemical Co.; Larry Baker, General Tire & Rubber Co.; Waldo Semon, B. F. Goodrich Co.; W. J. O'Brien, Seamless Rubber Co.; Sam Tanney, Tanney & Costello; and Leo Dete, Carlisle Corp.

Members associated with the rubber industry 50, 40, 35, and 30 years were then asked to stand, and W. E. Kavenagh, Goodyear Tire & Rubber Co., was the only member present in the 50-year class. C. R. Haynes, Binney & Smith; A. W. Holmberg, United States Rubber Co.; and Bancroft Henderson, American Cyanamid Corp., were those having 40 years or more service present at the meeting.

Bruce Silver, New Jersey Zinc Co., chairman of the committee on extending the scope of the activities of the Club, reported that many ideas in this connection had been received, but the committee was not ready to make a recommendation as yet. He requested that the members contribute further thoughts on this matter. The committee was continued until the next meeting of the Club, at which time its recommendations would be made.

It was announced that membership of the Club now totaled 330. The next meet-



Head Table at the Division Banquet: (Top, *Left to Right*): Norman Bekkedahl; E. H. Krismann, du Pont, Advertising Manager, *Rubber Chemistry and Technology;* H. E. Outcault, St. Joseph Lead Co., Division Councillor; C. W. Christensen, Monsanto Chemical Co., Division Treasurer; E. G. Holt; C. R. Haynes, Division Secretary; Warren G. Stubblebine; J. H. Fielding; Arthur Wolff; Waldo Semon, Division Chairman-Elect; A. H. Emery, A. C. S. Secretary; C. C. Davis, Boston Woven Hose & Rubber Co., Editor, *Rubber Chemistry and Technology;* A. W. Oakleaf; John T. Cox, Jr., Consultant, Local Committee

(Bottom, *Left to Right*): R. A. Kurtz, du Pont, Director, Philadelphia; R. A. Clark, Battelle Memorial Institute, Director, Southern Ohio; G. P. Hollingsworth, Minnesota Mining & Mfg. Co., Director, Detroit; M. R. Buffington, Lea Fabrics, Inc., Director, New York; Francis S. Frost, Jr., Frost Rubber Works, Director, Chicago; R. G. Seaman, Editor, INDIA RUBBER WORLD; Henry F. Palmer, Kentucky Synthetic Corp., Director, Akron; E. C. Siverson, Buffalo Weaving & Belting Co., Director, Buffalo; M. E. Lerner, Editor, *Rubber Age;* W. J. O'Brien, Director, Connecticut; E. L. Hanna, Davol Rubber Co., Director, Rhode Island

ing will be held in connection with the Division meeting in New York in September. A. A. Somerville, R. T. Vanderbilt Co., will be chairman for the New York meeting

The Business Meeting

At the business meeting on Thursday morning, March 1, Mr. Fielding asked the members to stand in silent tribute to two members, Henry B. Morse, Endicott-Johnson Co., and Leon T. Wilson, American Wringer Co., whose deaths occurred during the past year.

The appointment of Mr. Oakland as assistant treasurer of the Division was announced. F. W. Stavely, Firestone Tire & Rubber Co., and most recent past chairman, was appointed A. C. S. councillor to fill the place vacated by S. G. Byam, du Pont. A. M. Neal, du Pont, was appointed as alternate for Dr. Stavely.

Mr. Fielding reported that the financial status of the Division was good. The committee headed by L. V. Cooper, Firestone Tire & Rubber Co., which has been appointed to study the matter of increasing the dues of the Division, recommended that such action be deferred at this time.

The Division chairman also complimented the Washington local committee for its work and announced that for the meeting in New York during the week of September 3, D. E. Jones, American Hard Rubber Co., would head the committee on local arrangements. The program for this meeting, which will be in the form of five symposia, has been completed, and the papers have been received. The time and place of the 1952 meetings of the Division have not been decided.

The membership committee headed by J. F. Kerscher, Goodyear, reported 60 new regular and 22 new associate members had been obtained since October, 1950. The total membership of the Division as of February 26 was therefore given as 2,057 of which 297 are associate members. The discrepancy between the present total membership and the 2,725 reported at the Cleveland meeting in October, 1950, is due to the fact that earlier report included subscriber and agency members while the latest report does not include these categories.

The chairman of the nominating committee, J. N. Street, Firestone, reported the following candidates for offices and directors for the year 1952: Vice chairman, S. G. Byam and J. H. Ingmanson, Whitney Blake Co.; secretary, C. R. Haynes; treasurer, Amos Oakleaf. Directors from the areas of the sponsored local rubber groups: Connecticut, S. M. Boyd, U. S. Rubber, and R. H. Dudley, Whitney Blake; Detroit, G. M. Wolfe, Sharples Chemicals, Inc., and H. W. Hoerauf, U. S. Rubber; Northern California, J. A. Sanford, American Rubber Mfg. Co., and R. A. Claussen, Pioneer Rubber Mills; Philadelphia, T. J. Gorman, Quaker Rubber Corp., and C. A. Bartle, du Pont; Rhode Island, F. W. Burger, Kleistone Rubber Co., and H. L. Ebert, Firestone; Southern Ohio, G. H. McFadden, Ohio State Research Foundation, and Paul O. Powers, Battelle Institute; and Washington, Gerald Reinsmith, Ordnance Department, U. S. Army, and Harry L. Fisher.

The Division Banquet

The banquet of the Division on March 1 attracted an attendance of about 600, who enjoyed an excellent meal and a fine program of entertainment arranged by John T. Cox, Jr.

There were no speeches during the banquet, but Chairman Fielding did announce that W. C. Geer, consultant, had been selected to receive the Goodyear Medal of the Division at the September meeting in New York.

Those seated at the head table, including the speakers at the symposium on Thursday afternoon, are shown in the accompanying illustrations, except for James M. Crowe, executive editor, *Chemical and Engineering News.*

The Ladies' Program

The ladies' program committee, headed by Mrs. R. J. Fanning, NBS, provided an interesting program for wives of members of the Division during their three-day stay in Washington. Two mornings and one afternoon were occupied with visits to Alexandria, Arlington, and Mount Vernon and trips to public buildings in the nations' capital.

Wednesday evening was devoted to a concert of the National Symphony Orchestra, at Constitution Hall.

The tea scheduled at the British Embassy was unavoidably cancelled due to diplomatic obligations, but owing to the kindness of Mrs. Warren Lockwood and Mrs. H. C. Bugbee, wives of the director and assistant director, respectively, of the National Rubber Bureau in Washington, a tea was given for 90 guests at the Mayflower Hotel. Contributing to the success of the affair was the presence of a number of wives of official Washington dignitaries. Among these were the wives of several ambassadors, Mrs. G. C. S. Corea, from Ceylon; Mrs. Ali Sastroamidjojo, from Indonesia; Mrs. J. A. van Roijen, from the Netherlands; and Mrs. A. H. Ispahani from Pakistan. Mrs. Pierre Millet, wife of the councillor to the French Embassy, represented Madame Bonnet, wife of the French ambassador. Mrs. Paul Porter, wife of the former head of the Office of Price Administration, and Mrs. Horace McCoy, wife of the Assistant Administrator for Industrial Operations of the NPA of the Commerce Department, also attended.

A banquet for the ladies was held on Thursday evening at the same time that the division banquet was held. A fashion show was a feature of the program, with commentary by Miss Annette Ward, of the Washington staff of the Fairchild publications of New York. The ladies' banquet program was concluded with a talk by Miss Katherine Smith, of the National Canners Association, on "History of the Nation's Food Habits."

Division of High Polymer Physics, APS, Washington Meeting

THE Division of High Polymer Physics of the American Physical Society will hold a two-day meeting in Washington, D. C., April 26 and 27, as part of a meeting of the parent Society. The Wardman Park Hotel has been designated as the Division's headquarters, but the technical sessions will be held at the National Bureau of Standards.

The program will consist of a symposium on "Transitions in Polymers" on the morning of April 26 and a second symposium on "The Relative Effects of Frequency and Temperature on Dynamic Mechanical Properties" on the afternoon of the same day. The third session, which will begin on the morning of April 27, will be made up of one invited and eight contributed papers of a more general nature.

The meeting is open to both members and non-members of the American Physical Society, and no registration fee is charged. The titles and the authors of the papers to be presented follow:

THURSDAY MORNING—APRIL 26—9:30 A.M.
NBS—EAST BLDG. LECTURE ROOM
L. A. WOOD, PRESIDING
"TRANSITIONS IN POLYMERS"

Factors Influencing Glass Formation and Crystallisation in Polymers. Thomas G. Fox, Jr., Rohm & Haas Co., Philadelphia, Pa. (Invited paper.)

X-ray Scattering from Polystyrene as a Function of Temperature. S. Krimm and A. V. Tobolsky, Princeton University, Princeton, N. J.

Pressure-Volume Relationships of Rubber and Other Polymers. C. E. Weir, NBS.

Studies in Plasticization of Polyvinyl Chloride—III. The Plasticized State: A Special Application of Solubility Principles. M. L. Dannis, B. F. Goodrich Research Center, Brecksville, O.

Length-Temperature Behavior of Rubbers. M. J. Forster and H. L. Anthony, University of Notre Dame, South Bend, Ind.

The Determination of the Degree of Crystallinity in Natural Rubber by Dilatometric Methods. R. N. Work, NBS.

HIGH POLYMER PHYSICS, GENERAL

Dielectric Constant of Rubber-Carbon Black Mixtures. Clinton M. Doede, Connecticut Hard Rubber Co., New Haven, Conn.

Theory of Reinforcement in Hydrocarbon and Silicone Rubbers. Henry A. Fairbanks, Charles A. Walker, Clinton M. Doede, Connecticut Hard Rubber Co.

THURSDAY AFTERNOON—APRIL 26—2:15 P.M.
NBS—EAST BLDG. LECTURE ROOM
A. V. TOBOLSKY, PRESIDING
"THE RELATIVE EFFECTS OF FREQUENCY AND TEMPERATURE ON DYNAMIC MECHANICAL PROPERTIES"

Introduction to the Symposium. A. V. Tobolsky.

The Use of Reduced Variables to Describe Temperature and Frequency Dependence of Dynamic Mechanical Properties. John D. Ferry, University of Wisconsin, Madison, Wis.

Dynamic Studies of Polyisobutylene. T. W. DeWitt, Mellon Institute of Industrial Research, Pittsburgh, Pa.

Temperature and Frequency Effects on Dynamic Properties: Results of the Cooperative Program. Robert S. Marvin, NBS.

Temperature and Frequency Effects in the Dynamic Behavior of Swollen and Unswollen Rubber. A. W. Nolle, University of Texas, Austin, Tex.

Summary and Discussion. H. S. Sack, Cornell University, Ithaca, N. Y.

FRIDAY MORNING—APRIL 27—9:30 A.M.
NBS—MATERIALS TESTING LABORATORY LECTURE ROOM
J. B. NICHOLS, PRESIDING
HIGH POLYMER PHYSICS, GENERAL

Studies of High Polymers by Nuclear Absorption. R. S. Codrington, F. McCaffrey, B. A. Mrowoa, E. Guth, University of Notre Dame. (Invited paper.)

Nuclear Magnetic Resonance Absorption in Proteins. T. M. Shaw and K. J. Palmer, Western Regional Research Laboratory, United States Department of Agriculture, Albany, Calif.

The Three-Dimensional Patterson Function of Air-Dried Lysozyme Chloride. Robert B. Corey, Jerry Donohue, Kenneth N. Trueblood, California Institute of Technology, Pasadena, Calif., and K. J. Palmer.

Dynamic Shear Properties of Isobutylene Polymers as a Function of Cross-Linking. I. L. Hopkins, Bell Telephone Laboratories, Murray Hill, N. J.

Energy Dissipation in Vibrating Fibers. W. G. Hammerle and D. J. Montgomery, Textile Research Institute, Princeton.

The Application of Nutting's Equation to the Viscoelastic Behavior of Certain Polymeric Systems. Rolf Buchdahl and Lawrence E. Nielsen, Monsanto Chemical Co., St. Louis, Mo.

Flow Behavior of Highly Concentrated Cetane Solutions of Low Molecular Weight Polyisobutylenes. A. B. Bestul and H. P. Belcher, NBS.

Sedimentation and Diffusion of Charged Macromlecules. F. Eirich and H. Mark, Polytechnic Institute of Brooklyn, Brooklyn, N. Y.

Densities and Optical Properties of High Polymers. Maurice L. Huggins, Eastman Kodak Co., Rochester, N. Y.

Talalay on Foam Rubber

A TALK on "Foam Rubber—Manufacture, Design Engineering, Properties," by Leon J. Talalay, Sponge Rubber Products Co., was the feature of the winter meeting of the Connecticut Rubber Group on February 23. Approximately 140 members and guests were present at the meeting, which was held at the Hotel Barnum, Bridgeport, and included a cocktail hour and dinner. The program also included a talk by Dave Powers, author and lecturer, on "How to Sell Your Ideas."

Mr. Talalay began by reviewing the growth of the foamed latex industry during the past five years, noting that 60% of the latex consumed domestically is used in foam. Test methods for evaluating the physical properties of foam were briefly described, as were the relations between foam density to tension strength, elongation, and resistance to compression. Most foam rubber is made with cores projecting into the body of the foam, and the trend in core design is toward the use of a greater number of smaller cores.

The speaker discussed the compounding of foam rubber, including the effects of sulfur ratio, increased loadings of fillers, and the substitution for natural latex of "hot" GR-S latex (Type 5) and "cold" GR-S latex (Type X-547). The tensile strength and elongation of 100% Type X-547 latex foam was shown to be about six times that of 100% Type 5 latex foam. The two main processes used for making foam are the Dunlop and Talalay processes. The Dunlop process uses mechanical entrainment of air for foam generation, and the delayed action hydrolysis of sodium silicofluoride for gelling. The Talalay process uses catalytic decomposition of hydrogen peroxide for foam generation, and coagulation of the foam in the frozen state by injection of coagulating gas.

A discussion was also given of the colloidal conditions which must prevail in the latex compound for successful foam manufacture, such as the effect of surface tension, liquid film strength, viscosity, and the conditions for the formation of the zinc-ammonia complex in the sol-gel transformation. Mr. Talalay concluded with a description of foam shrinkage, and the operations of washing, drying, and finishing.

Non-Black Pigments

A TALK on "Non-Black Pigments in Rubber," by Alan R. Lukens, Lukens Laboratories, highlighted the March 9 dinner-meeting of the Chicago Rubber Group, held at the Morrison Hotel, Chicago, Ill., with approximately 175 members and guests attending.

Dr. Lukens classified the various non-black pigments which have been used in rubber into 30 different groups and briefly described the properties imparted to rubber by the principal groups. The calcium carbonates were described in some detail, with special emphasis on Laminar, a new calcium carbonate pigment made from ground oyster shells by Lukens. According to the speaker, Laminar increases the extrusion rate of rubber and improves the smoothness of extrusions without lowering the physical properties of the vulcanizates. The advantages of Laminar over conventional calcium carbonates are attributed to the fact that the crystal structure is aragonite and not calcite, and that the material is composed of plate-like particles separated from each other by an organic coating derived from the oyster.

During the business session, several changes in the Group's by-laws were adopted to clarify the duties of the vice chairman, to split the office of secretary-treasurer into separate offices, and to provide for the election of only one-half the executive committee each year. A discussion was held as to possible incorporation of the Group, and the bonding of the treasurer, and a committee was appointed to study these matters.

During the cocktail hour preceding the dinner, oysters were served through the courtesy of Lukens Labs. Following his technical talk, Dr. Lukens showed stereoscopic color slides depicting trips through Louisiana and the West Indies. The meeting closed with a drawing for door prizes won by R. R. Blair, Columbia Chemical Division, Pittsburgh Plate Glass Co.; Jim Braden, Industrial Rubber Goods Co.; and Stan Choate, O'Connor & Choate.

Rayon SORG Meeting Topic

THE spring dinner-meeting of the Southern Ohio Rubber Group was held March 19 at the Engineer's Club, Dayton, O., with 61 members and guests attending. The technical session featured the showing of a sound slide film, "Rolling on Rayon," with a commentary by B. F. Benham and Thomas Tollner, both of Industrial Rayon Corp. This film described the production of rayon from its raw materials, and its manufacture into finished products. Following the film, Mr. Benham presided over an open forum on the use of rayon in the rubber industry.

In the business meeting preceding the technical session, Frank J. Newton, Dayton Rubber Co., who is Group treasurer and chairman of the arrangements committee for the annual summer outing, discussed plans for the outing which will be held on June 23.

Sherry and Kemp Speakers

TALKS on "Vinyl Plastisols for Molding and Dipping," by A. B. Sherry, Stanley Chemical Co., and "Some of the Outstanding Rubber Developments of the Last 30 Years at Bell Laboratories," by A. R. Kemp, consultant, highlighted the spring meeting of the Boston Rubber Group on March 16. Approximately 325 members and guests attended the meeting, which included a cocktail hour and dinner at the Somerset Hotel, Boston, Mass.

Mr. Sherry gave an interesting discussion of the rapidly expanding vinyl plastisol molding and dipping industry, noting that these products are widely used in wire and cable insulation and have largely supplanted rubber and latex in the doll-parts market. Advantages of doll-part production from plastisols include small initial capital investment, good duplication of pattern, natural feel of parts so made, brilliant colors available, quality and durability of products, and relative low cost of the process. Relatively simple equipment, consisting chiefly of molds, ovens, and cooling chambers, are required for plastisols.

The essentials of slush molding vinyl plastisols are as follows: the part is sculptured in wax, which is then silver coated, nickel plated, and finally copper plated to a total thickness of about 1/16-inch. The wax is then melted away, and the silver recovered, and the resultant metal mold is used to shape the plastisol. In molding, the plastisol is poured into the mold and allowed to build up to desired thickness on the interior mold surfaces; excess plastisol is drained off; the built-up coating fused by heating, and the mold then cooled to remove the finished part. Most parts require one or two pouring operations to build up the desired wall thickness.

In plastisol dipping, the hot form is dipped into the plastisol, and a film is built up on the form. The form is then heated to set the plastic film further. Typical applications for this process include covering of handles on small tools, work gloves, and dipped binders for insulation.

Dr. Kemp, now a rubber consultant following his recent retirement from Bell Telephone Laboratories, Inc., discussed rubber developments at the Laboratories and Western Electric Corp. during his 30 years in charge of rubber, plastics, and organic research. Some of the points discussed were the development of the continuous vulcanizer for rubber covered wire, the use of synthetic rubbers in wire insulation and jacketing, and the installation and operation of the Western Electric "push-button" plant at Point Breeze, Baltimore, Md. Dr. Kemp also spoke briefly on a report on Armed Services' rubber laboratories and testing facilities which he recently completed for the government.

Annual Ski Outing

The Boston Rubber Group held its third annual ski outing on February 9-11 at Juniper Hill Inn, Windsor, Vt., with some 34 members participating. Snow conditions were quite good; there were no broken bones, and a good time was had by all. Walter Edsall, Goodyear Tire & Rubber Co., was in charge of arrangements for the outing.

Rubber Fillers Symposium

A SYMPOSIUM on "Technological Importance of Non-Reinforcing Fillers in the Rubber Industry" was the feature of the afternoon technical session of the March 8 meeting of the Elastomers & Plastics Group, Northeastern Section, American Chemical Society, held at Massachusetts Institute of Technology, Cambridge, Mass. Morris Omansky, consultant, presided over the technical session, at which 90 members and guests were present, and the symposium speakers were Harold S. Liddick, Davidson Rubber Co., and Edward E. Stritter, Boston Woven Hose & Rubber Co.

Mr. Omansky's opening remarks on non-reinforcing rubber compounding ingredients, which were taken to include extenders and softeners, noted that while many of these materials are simple compounds, even the simplest have many characteristics of importance to the compounder. He noted that the materials under discussion were of relatively large particle size as compared with carbon blacks, since fine particle size is a characteristic of reinforcers.

Mr. Liddick spoke on fillers as they affect the properties and processing of rubber sundries. In discussing the various types of fillers, the speaker noted that their use is an art rather than a science inasmuch as it is necessary to balance the changes in product characteristics produced by each type of filler. It is not possible to draw hard and fast rules as to results to be obtained with any particular filler without considering the effects of all other components in the formulation. Mr. Liddick classified fillers as inorganic mineral fillers, diluents, plasticizers, lubricants, organic fillers, special carbon blacks (thermal and conducting types not primarily used for reinforcing purposes), special modifiers, and miscellaneous. The speaker concluded by showing slides of rubber processing equipment and by commenting on special uses of some materials to improve handling, such as improving hot tear resistance to permit rapid emptying of molds after curing.

Mr. Stritter spoke on the use of fillers to secure desired properties in mechanical rubber goods. He began with a discussion of ingredients as they affect processing, such as the value of a clay-whiting balance for control of plasticity variations with reclaims, the value of fillers for killing the nerve of GR-S and some rubber compounds, and the comparative values of solvating and tackifying softeners. The influence of ingredients on vulcanization was discussed, including alkalinity and acidity, catalytic effects of trace metals, filler migration, and tendency of many fillers to absorb sulfur or accelerators. Mr. Stritter concluded with a discussion of cost factors and pointed out that many superior ingredients are ruled out when practical compounds are required.

The technical session was followed by a cocktail hour and dinner, with some 140 members and guests attending. Section Chairman John T. Blake, Simplex Wire & Cable Co., presided over the dinner, at which Roy H. Kienle, American Cyanamid Co., spoke on "Physical Chemistry in Industrial Research."

Thixon Bonding Agents

THIXON is the new trade name for a line of tested bonding agents being manufactured by Dayton Chemical Products Laboratories, Inc., West Alexandria, O., and distributed in the eastern and midwestern areas by Harwick Standard Chemical Co., Akron, O. Thixon will designate various products developed and manufactured by Dayton for the rubber industry in the production of rubber-to-metal bonded assemblies. These products now include agents for use with natural rubber, GR-S, cold GR-S, neoprene, Butyl, and nitrile rubber.

The new trade name will replace formula numbers previously used by the manufacturer, and subscripts will be added to the name to differentiate between formulae used for different applications. Bonding agents produced for specific purposes include primary agents for use directly between metal surface and polymer, secondary agents for use in conjunction with the primary agent, and adhesion boosters to improve performance in special applications. The Thixon line of basic formulations, together with known modifications, is said to meet most rubber-to-metal bonding problems.

Discuss Wage Stabilization

A DISCUSSION of the new wage stabilization regulations was held at the March 1 meeting of the Northern California Rubber Group. Some 34 members and guests attended the meeting, held at the Elks Club, Berkeley. Chief speakers at the discussion were E. R. Stowell and F. Gonsalves, both of the San Francisco office of the Wage & Hour Division, United States Department of Labor. After brief talks by the speakers, the meeting was opened to questions from the floor.

During the business session preceding the discussion, President J. B. Watson, Goodyear Rubber Co., appointed James Stull, Pacific Rubber Co., chairman of the arrangements committee for the next Christmas party. Mr. Stull, in turn, appointed George Farwell, Goodyear Rubber, as his assistant on the committee. Treasurer J. A. Sanford, American Rubber Mfg. Co., announced the election of the following new members into the Group; Dana Andrews, American Rubber; Eugene Gador, Oliver Tire & Rubber Co.; Frank Groch, Pabco Mfg. Co.; and R. W. Scott, Plastic & Rubber Products Co.

Bureau of Ships Rubber Formulary

THE conversion during the early part of World War II of all rubber specifications from natural rubber to some form of synthetic rubber, wherever possible, left rubber technologists with the staggering task of supplying new workable formulations for the diverse needs of their manufacturing departments. This was a particular hardship upon the hundreds of small rubber companies, many of whom had very limited facilities for development work. To aid in this task the Bureau of Ships, taking advantage of extensive pre-war synthetic rubber research which had been undertaken at the request of the Munitions Board, was able to supply synthetic rubber formulations to many of the small companies. These formulations were reproducible on a factory scale because the laboratory recipes already had been confirmed by shop operation at the rubber shop of the Mare Island Naval Shipyard, Vallejo, Calif.

The present greatly increasing demand for all types of rubber products by all agencies of the Department of Defense, after several years of relatively slight procurement of rubber articles, has made desirable extensive dissemination of technically sound rubber compounding data applicable to government specifications. The Mare Island Rubber Laboratory Formulary for Bureau of Ships requirements presently includes 71 recipes covering 26 specifications as well as some nonspecification material and is now being revised and expanded substantially. Although these formulations have been found satisfactory in the rubber shop or rubber laboratory of the Mare Island Naval Shipyard for producing articles conforming to specifications, modifications may, of course, be necessary to adapt the formulations to the particular processing and production conditions existing in any individual factory.

It should be emphasized that the formulations are furnished solely for information, and that there is no intention whatever on the part of the Bureau to use these recipes as specifications or to incorporate them as an integral part of any specification.

Compounders who have saved time and effort by utilizing the information contained in the Formulary have been most enthusiastic about it and agree that the Formulary should be given broad circulation among the hundreds of manufacturers in the rubber industry.

The contribution by industry to the Formulary of technical compounding data referring to specific uses or particular specifications will be welcomed. Such information will be reviewed for suitability for government specifications and checked for reproducibility by the Mare Island Rubber Laboratory before incorporation into the Formulary and may then become part of the revisions and additions to the present compilation which are being prepared for future issue. While contributions will be acknowledged, formulations will not be specifically designated or identified as to source when published in the Formulary.

A list of the presently available formulations is given below. Manufacturers now engaged in or expecting to undertake production for government use may receive any of these formulations upon request to the Bureau, as long as the present supply is available. Requests should be addressed to Code 344, Bureau of Ships, Department of the Navy, Washington 25, D. C.

LIST OF FORMULATIONS AVAILABLE FOR DISTRIBUTION BY BUREAU OF SHIPS RUBBER BRANCH, CODE 344, NAVY DEPARTMENT

Index No.	Stock No.	Specification	Description
1	E-204-2	ZZ-H-541	Hose, steam
2	E-308-16	GGG-H-86, Type K, Class 2	Hammer heads
3	E-30-5		Diesel engine gaskets (neoprene)
4	E-194-269		Diesel cylinder liner gaskets
	E-194-270		Diesel cylinder liner gaskets
5	E-13-314		45 Duro gasket stock
6	E-20-35		Neoprene gaskets
7	E-275-31		O-ring packing
8	E-222-8	11V1(INT)	Valves, pump rubber
	E-222-12	11V1(INT)	Valves, pump rubber
	E-222-11	11VI(INT)	Valves, pump rubber
9	H-3-1	17C28	Hard rubber
10	S-8-2	17C28	Ventilation duct sleeves
11	E-121-37	17J3	Hard rubber
12	E-40-85	27M13	Matting
13	E-194-5	33G7	Gaskets, oil-resistant
14	E-194-15	33G7	Gaskets, oil-resistant
	E-194-180	33G7	Gaskets, oil resistant
15	E-9-236	33G7	Oil-resistant gasket for low temperature use
16	E-69-70, 71, 72, 73	33G10	Gaskets, cold storage
17	E-69-96	33G10	Gaskets, cold storage
18	P-7-1	33G10	Gaskets, cold storage
19	E-225-15	33G14	Gaskets, rubber tubing
20	E-194-200	33G17	Gaskets, drum
21	E-129-9	33H4	Hose, oil suction and discharge
	E-232-3	33H4	Hose, oil suction and discharge
22	E-163-32	33H8 Class I	Hose, gasoline, wire stiffened
	E-163-21	33H8 Class II	Hose, gasoline, wire stiffened
	E-163-26	33H8 Class II	Hose, gasoline, wire stiffened
	E-163-27	33H8 Class III	Hose, gasoline, wire stiffened
23	E-163-100	33H9 Class I	Hose, air, diving apparatus
	E-163-101	33H9 Class III	Hose, air, diving apparatus
	E-163-102	33H9 Class III	Hose, air, diving apparatus
24	E-163-181	33H9 Class I	Hose, air, diving apparatus
	E-163-179	33H9 Class III	Hose, air, diving apparatus
25	E-163-181	33H14 Class I	Hose, submarine chamber
	E-163-179	33H14 Class III	Hose, submarine chamber
26	E-246-3	33H19	Hose, paint or dope spray
	E-246-4	33H19	Hose, paint or dope spray
27	E-163-32	33H31 Class I	Hose, gasoline
	E-163-193	33H31 Class II	Hose, gasoline
	E-163-186	33H31 Class III	Hose, gasoline
28	N-8-3	33L4 Class I	Lining, Sub. Byt. Comp.
29	E-229-4	33P23	Packing, unvulcanized
30	E-162-124	33R1	Packing, gasket
31	R-10-4	33R4	Rubber, med. soft, gasket
32	E-13-268	33R4	Rubber, med. soft, gasket
33	E-169-13	33R6	Shaft covering
34	E-166-176	33R6	Shaft covering
	E-166-192	33R6	Shaft covering
35	C-22-1	33R7	Cement for shaft covering
	C-12-4	33R7	Cement for shaft covering
	H-6-4	33R7	Base stock shaft covering
	S-11-2	33R7	Face stock for shaft covering
36	E-156-247	33R9, Class 1	Med. soft gaskets
37	E-162-259	33R9, Class 2	Med. soft gaskets
38	E-194-224	33R9, Class 3	Med. soft gaskets
	E-194-239	33R9, Class 3	Med. soft gaskets
39	S-3-11	33R9, Class 2	Med. soft gaskets
40	E-245-6	52C10	Cement, Butyl
41	E-233-190	52C38	Compound, preservative
42	E-154-38	AN-C-54	Cement, rubber
	E-154-39	AN-C-54	Cement, rubber

Rubber & Plastics Division, ASME, Toronto Meeting

THE Rubber & Plastics Division of the American Society of Mechanical Engineers is holding a one-day meeting in Toronto, Ont., Canada, June 14, at the Royal York Hotel. This meeting, which will consist of one technical session on rubber and another on plastics, will be a part of the meeting of the parent Society. W. Newlin Keen, E. I. du Pont de Nemours & Co., Inc., is chairman of the Rubber & Plastics Division.

The titles and authors of the papers to be presented at the meeting and the chairman and vice chairman for the two sessions are given below:

RUBBER SESSION—THURSDAY MORNING—JUNE 14
CHAIRMAN: NORMAN A. GRACE, DUNLOP TIRE & RUBBER GOODS CO., LTD., TORONTO
VICE CHAIRMAN: J. I. G. BELL, CANADIAN INDUSTRIES, LTD., TORONTO

Engineering Properties of Silicone Rubbers. P. C. Servain, Dow Corning Corp., Midland, Mich.

Synthetic Elastomers for Use at Low Temperatures. S. G. Einhorn and N. R. Legge, Polymer Corp., Ltd., Sarnia, Ont.

Neoprene Applications in Engineering Design. Richard W. Malcolmson, du Pont, Wilmington, Del.

PLASTICS SESSION—THURSDAY AFTERNOON—JUNE 14
CHAIRMAN: J. B. FARRELL, FARRELL PLASTICS, LTD., TORONTO
VICE CHAIRMAN: R. M. FERGUSON, R. M. FERGUSON & CO., TORONTO

Electric Control of Air Flow Porosity in Plastic Sheet Materials. J. J. Suran, John W. Meaker & Co., New York, N. Y.

Effect of Orientation on the Mechanical Properties of Polystyrene. Albert G. H. Dietz and Robert G. Cheatham, Massachusetts Institute of Technology, Cambridge, Mass.

Evaluation of Acrylic Glazing Materials for Aircraft Enclosures. G. M. Kline and B. M. Axilrod, National Bureau of Standards, Washington, D. C.

Additional Experimental GR-S Polymers and Latices

ADDITIONS to the list of experimental GR-S dry polymers and GR-S latices, available for distribution to rubber goods manufacturers under the conditions outlined in our November, 1945, issue, page 237, appear in the table below.

Normally, experimental polymers will be produced only at the request of the consumers, and 20 bales (one bale weighs approximately 75 pounds) of the original run will be set aside, if possible, for distribution to other interested companies for their evaluation. The 20 bales, when available, will be distributed in quantities of one bale or two bales upon request to the Sales Division of Rubber Reserve, or will be held for six months after the experimental polymer was produced, unless otherwise consigned before that time. Subsequent production runs will be made if sufficient requests are received.

These new polymers are experimental only, and the Office of Rubber Reserve does not make any representations or warranties of any kind, expressed or implied, as to the specifications or properties of such experimental polymers, or the results to be obtained from their use.

X-Number Designation	Manufacturing Plant	Date of Authorization	Polymer Description
X-466 GR-S-SP	U. S. Rubber, Naugatuck	11-17-50	Stabilizer content to read 1.25% Stalite.
X-542 GR-S	Goodrich, Port Neches	12-14-50	Activated with cumene hydroperoxide or diisopropylbenzene monohydroperoxide or a mixture of both.
X-567 GR-S-SP	U. S. Rubber, Naugatuck	11-17-50	Description changed to read: "Same as GR-S-86-SP, except stabilized with 1.25% Wingstay-S."
X-577 GR-S	Goodrich, Port Neches	12-14-50	Activated with cumene hydroperoxide or diisopropylbenzene monohydroperoxide or a mixture of both.
X-602 GR-S	Phillips, Borger	11-13-50	Butadiene styrene charge ratio 72/28, activated with diisopropylbenzene hydroperoxide and/or Diox 7, polymerized at 0° F. Emulsified with Dresinate S-149 and K-ORR soap; shortstopped with DNCB and hydroquinone. Mooney viscosity, 50±5. Stabilized with 1.25% BLE.
X-603 GR-S	Goodrich, Port Neches	11-13-50	GR-S stabilized with PBNA. To be used as the standard reference test sample beginning January 1, 1951.
X-604 GR-S	General, Baytown	11-14-50	A mixture of 50±2 parts Philblack 0 and 100 parts GR-S type polymer. Sodium lignin sulfonate, lignin, and Dresinate 214 used in carbon black slurry make-up. Butadiene styrene charge ratio 71.5/28.5; activated with cumene hydroperoxide and/or diisopropylbenzene hydroperoxide; polymerized at 41° F. Emulsified with K-ORR soap; shortstopped with DNCB. Shortstopped Mooney viscosity, 36±5 (ML-4 at 212° F.). Stabilized with 1.5% PBNA.
X-605 GR-S	General, Baytown	12-6-50	A mixture containing 50±2 parts of reinforcing furnace black Aromex and 100 parts of GR-S type polymer. Shortstopped Mooney viscosity, 43±5 (ML-1.5 min. at 212° F.). Stabilized with 1.5% PBNA.
X-606 GR-S	General, Baytown	12-6-50	Same as X-605 GR-S, except Vulcan 3 used instead of Aromex.
X-607 GR-S	General, Baytown	12-6-50	A mixture of 50±2 parts Aromex and 100 parts GR-S type polymer polymerized at 41° F. Sodium lignin sulfonate, Dresinate 214, and lignin used in carbon black slurry make-up. Butadiene styrene charge ratio 71.5/28.5; activated with cumene hydroperoxide or diisopropylbenzene hydroperoxide or a mixture of both. Emulsified with Dresinate 214 and K-ORR soap; shortstopped with DNCB. Shortstopped Mooney viscosity, 36±5 (ML-4 at 212° F.). Stabilized with 1.5% PBNA.
X-608 GR-S	General, Baytown	12-6-50	Same as X-607 GR-S, except Vulcan 3 used instead of Aromex.
X-609 GR-S	General, Baytown	12-6 50	Same as X-607 GR-S, except Improved Kosmos-60 used instead of Aromex.

Safety Council Contest Awards

AWARD winners in the 1950 Rubber Section contest of National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill., have been announced. The 118 contestants finishing the contest reported a total exposure of more than 318,000,000 man-hours worked and a total of 1,763 injuries. This is an increase of 10% in exposure and 27% in injuries over 1949 contest results. The average accident frequency rate (injuries per million manhours) was 5.54, an increase of 15% over the 1949 figures. The Rubber Section contest is divided into five divisions, and the recorded frequency rates were as follows: I (over 400,000 manhours per month), 4.64; II (200,001-400,000 manhours per month), 6.48; III (100,001-200,000 manhours per month), 4.21; IV (50,000-100,000 manhours per month), 9.48; and V (under 50,000 manhours per month), 8.40.

First-place winners in each division receive a trophy; while second, third, and special award winners receive certificates. Winners in each division, in order of award and with frequency rate shown, were as follows: Division I—Firestone Tire & Rubber Co. of California, 0.51, Firestone Tire & Rubber Co.'s Akron Plant #2, 0.79, and Firestone's Akron Plant #1, 1.05; Division II—Dominion Rubber Co., Ltd., St. Jerome plant, 1.09, United States Rubber Co. Indianapolis plant, 1.79, and B. F. Goodrich Co. Tuscaloosa plant, 2.02; Division III—Electric Hose & Rubber Co., 0.48; Goodrich's Akron aeronautical division, 0.58, and Dominion Rubber's Papineau plant, 1.05; Division IV—U. S. Rubber's Milan plant, 0.00, U. S. Rubber Reclaiming Co. Buffalo plant, 0.00, B. F. Goodrich Chemical Co.'s Port Neches plant, 0.00, and Van Cleef Bros., Inc., Chicago plant, 0.00 (a four-way tie); and Division V—a 15-way tie, all with perfect records, of General Tire & Rubber Co.'s Baytown plant, Firestone Plastic Co.'s Pottstown plant, Firestone's Akron synthetic division, research laboratory, and retread shop, and the Memphis Xylos Rubber Co. plant, University of Akron, U. S. Rubber's Manchester and Burlington plants, Goodrich's Du Bois plant, National Automotive Fibres, Inc., Trenton plant, Flintkote Co. of Canada's New Toronto plant, Goodyear's Niagara plant, Fabric Hose Co. Sandy Hook plant, and Roth Rubber Co. Cicero plant.

Certificates of achievement for greatest numerical reduction in frequency rates were won by the following: Division I, Goodyear's Plant 2 (tires and reclaim); Division II, Goodyear's St. Mary's plant; Division III, Armstrong Rubber Mfg. Co.'s Des Moines plant; Division IV, Sponge Rubber Co.'s Plants B and C at Shelton; and Division V, Oliver Tire & Rubber Co.'s Oakland plant.

Witcosil 40, a Reinforcer

WITCOSIL 40, a new reinforcer for rubber compounds which has aluminum silicate as its basic ingredient, is being marketed by Witco Chemical Co., 295 Madison Ave., New York 17, N. Y. Particle size of the new product has been determined as 106 Angstrom units, which is comparable to that of MPC and HMF carbon blacks, and it is this fineness that is said to impart superior reinforcing properties to rubber compounds. Other results obtained by use of the new product include good flex resistance with very low heat built-up, tensile and abrasion properties comparable with carbon black, and superior aging.

The new reinforcer is light gray in color, has a pH of 8, and a specific gravity of 2.35. It can be readily incorporated into rubber on a roll mill or in a Banbury using up to 200 parts Witcosil 40 per 100 parts rubber hydrocarbon, but best results are obtained at loadings up to 50 parts per 100 RHC. The new product is said to be an ideal reinforcing filler in rubber formulations for heels, soles, rubber rollers, and stocks for other mechanical goods where a color other than black is desired.

Enlarging Chicago Lab

A new 40- by 80-foot two-story wing is being added to the Chicago, Ill., laboratories of Witco Chemical. This addition will provide increased research facilities to accommodate a greatly enlarged staff.

On the second floor will be a research laboratory 33 by 40 feet designed and equipped in line with the latest developments in modern practice. Here developmental work on new products will be carried out as well as general experimental work on organic chemicals such as esters, stabilizers, metallic soaps, and paint driers.

A control laboratory 23 by 40 feet with separate entrance will consolidate the various control laboratories now located throughout the plant. Office space is also provided, and the library will be considerably enlarged.

The ground level will house an expansion of the rubber technical service laboratory in which carbon blacks, M.R., softeners, processing aids, and Sunolite waxes will be evaluated, customers' problems investigated, and data developed for incorporation into technical bulletins for the rubber industry. Also included on this floor will be the experimental machine shop and storage space for non-flammable chemicals and rubber compounding ingredients.

NEWS of the MONTH

NPA Revises M-2 Order and Rubber Allocation Method; Senate Investigates Rubber Allocations

The NPA instituted a thoroughly revised M-2 Order in March, placing allocations on a quarterly basis, with new adjusted base periods for consumers and imposing specific limitations on the natural rubber content of thousands of rubber products.

The Senate Small Business Committee on March 26 began full public hearings into the effect of rubber allocations and supply on small manufacturers of rubber products.

The NPA established a detailed review procedure for handling appeals for changes in new rubber allocations under the new adjusted base periods method.

Some details of the organization of the Washington government agencies responsible for various aspects of the present rubber program have been obtained.

Basic machinery has been developed for the allocation of chemicals through NPA Order M-45 although no chemical had actually been placed under control in late March.

The ten governments, representing rubber producing and consuming nations, which met in London in February, will resume discussion of rubber supply problems in Rome, Italy, just prior to the opening of the Rubber Study Group Conference in that city on April 16.

John L. Collyer, president of The B. F. Goodrich Co., in a letter to Economic Stabilization Administrator Eric Johnston urged the government not to enter into any rubber price cartels or fixed-price contracts with natural rubber producers.

The United Rubber Workers of America, CIO, indicated that it intends to make new economic demands on the industry in the near future.

Washington Report

By

ARTHUR J. KRAFT

NPA Revises M-2 Order

The National Production Authority put into effect during March a thoroughly amended M-2 order, placing allocations on a quarterly basis and imposing specific limitations on the natural rubber content of thousands of end-products.

The allocations were made effective on March 1 and the specification controls on March 15. The specifications, drawn up by industry task groups, were considerably milder than those imposed during World War II. They were designed, at NPA's instruction, to permit continued production of good-quality products, not simply products of adequate quality.

Many of the items to which specifications were applied are permitted to contain the minimum quantity of natural rubber necessary, a determination left up to the individual manufacturer. The amended M-2 should result generally in a reduction of natural rubber content amounting to about 10% in transportation products and about 15 to 20% in mechanical goods. Other segments of the industry will operate under specifications requiring roughly similar limitations.

In some products, natural rubber was ordered eliminated entirely. For such major items as automobile tires, the natural rubber content was limited to 15% for the 7.10 and 6.50 sizes; while for low-pressure passenger-car tires the limitation was placed at 22%.

The specifications were tailored to fit a monthly civilian consumption of 25,000 long tons of natural rubber, a total which NPA said it will probably hold at least through May.

Including some 5,000 tons of natural and synthetic latices, civilian consumption is expected to average about 90,000 tons a month. The 30,000 tons of natural rubber, dry and latex, provided for civilian goods in March is a reduction of 5,000 tons from January and 2,000 tons from February. Civilian consumption of new rubber in those months averaged 88,500 tons.

The new allocations were invoked after NPA, completing a two week review of the adjusted base periods for each rubber consumer, issued revised base periods which, in aggregate, reduced the industry's base from 1,430,762 to 1,076,110 tons. Consumers were authorized to use 95% of their adjusted base-period consumption of new rubber in March and 48% of their adjusted base usage of natural rubber.

The natural rubber latex base was increased to 51,020 tons, and beginning April 1, when this material will be allocated separately, consumers will be permitted to consume at 114%—58,163 tons—of this rate.

Consumers of less than 25,000 pounds of new rubber quarterly are exempt from usage restrictions.

NPA has recruited a staff of technicians to handle requests from consumers who, because their ratio of natural to synthetic usage will be changed by the specification controls, want to trade allocations of one type of rubber for another type.

The new allocation program, announced to the public on February 24, was reviewed by NPA with its Rubber Industry Advisory Committee on February 26. NPA said that the next area to which it will turn attention is a study of essentiality and the problems involved in expediting not only direct defense uses of rubber products, but those in defense-supporting industries as well. Mines, steel mills, and refineries were cited by Rubber Director Leland E. Spencer as industries whose increasing requirements for rubber equipment will require increased production, probably at the expense of some other civilian items.

At the suggestion of the industry committee, Rubber Reserve officials, attending the meeting at NPA invitation, agreed to "spearhead a simplification program to save styrene," NPA said. The industry men pointed out that a reduction in the number of types of GR-S now being made and certain formula changes would free some styrene for use by the plastics industry.

NPA said its Rubber Division is giving immediate service to applications for new rubber under defense rated orders. Any small company, the committee was informed, can bid on a defense order regardless of whether it has the rubber in stock to fill it. Spencer announced the establishment of a unit to audit rubber consumption.

NPA met with representatives of the industrial rubber products branch early in March to launch the essentiality study. Some members of the group contended that NPA should have adopted greater limitations on the use of natural rubber in dolls and toys, or severely cut down on the output of non-essential items, because of the difficulties encountered by manufacturers in filling their rubber requirements for more essential products.

Heavy use by rubber product consumers of DO-97 priority ratings has, in some cases, compounded the difficulty of some rubber manufacturers in attempting, despite lowered production schedules, to keep their regular customers satisfied. Rubber used to make products delivered on a DO-97 priority rated order must come out of allocations for civilian consumption.

NPA authorized industry generally to apply this rating to orders submitted to suppliers for maintenance, repair, and operating equipment. Trucking companies, fearful of tire shortages, have used the DO-97 to stock up, and other industries have rather freely applied the rating to orders for mechanical goods.

The NPA in late March was considering corrective action to this situation along with other possible amendments to M-2, including a cutback in April consumption of new rubber and the allocation of cold rubber separately from the broad category of new rubber.

The cutback was necessitated by a fire early in March at the Kobuta, Pa., alcohol-butadiene plant which resulted in a loss of approximately 3,500 tons of GR-S in March and is expected to result in a like loss in April.

As a result of the Kobuta disaster, Rubber Reserve's March production was expected to total some 53,500 tons of GR-S, or 3,500 tons short of the target on which NPA based the March allocation of new rubber. It is expected to bring production to 54,000 tons in April, instead of the 60,000 tons planned earlier.

There is some possiblity that the cutback in new rubber use for April might be to 80% of adjusted base-period consumption instead of the 95% stated in the March 1, M-2 Order. Industry leaders, in late March, were seeking a hearing with NPA Administrator Manly Fleischmann to have the April cutback made less severe. It is understood that the NPA felt that the 80% figure was necessary to take care of both the DO-97 rated orders and the loss of GR-S due to the Kobuta fire.

Senate Investigates Allocations

Senator Guy M. Gillette (D., Iowa) announced in mid-March that a special five-man subcommittee of the Senate Small Business Committee would launch on March 26 a full public hearing into the impact of rubber allocations and supply on small manufacturers of rubber products.

Gillette said the hearings would delve

into "critical problems of small rubber companies. There are grounds for grave doubt," he asserted, "that available supplies of rubber are being allocated equitably among small and large manufacturers of rubber products. I have personal knowledge of several small rubber companies which are on the brink of bankruptcy because they cannot obtain sufficient rubber to operate at even a mere 'break-even' point. The larger companies, on the other hand, seem to be experiencing little difficulty in continuing profitable operations." The hearings, he said, will continue "long enough for any small rubber goods manufacturer who is encountering unreasonable hardship to present his complete story to the subcommittee." Gillette further declared the subcommittee also will "expore fully the present basis for operations of the government-owned synthetic rubber plants with a view to permitting additional and increased participation by small rubber companies."

Other members of the subcommittee, besides Gillette, who is chairman, are Russell B. Long (D., La.) Lester C. Hunt (D., Wyo.), Edward J Thye (R. Minn.), and Robert S. Hendrickson (R., N. J.)

The Committee's counsel, Charles E. Shaver, prepared the groundwork for the hearings in almost daily consultation with small rubber company representatives throughout March. It is understood that the subcommittee also planned to look into the difficulties encountered by the General Services Administration in buying natural rubber in the Far East. Shaver reported that the investigators would ask Administrator Jess Larson to report on this situation.

In preparing for the hearings, at which some 35 to 40 witnesses may be heard, the counsel distributed to 1,050 consumers of rubber a nine-point questionnaire on March 9, with a request that replies be made by March 17. Shaver also consulted with Earl W. Glen, former director and then deputy-director of the NPA Rubber Division.

The subcommittee said that it intends to conduct the inquiry with a "very open mind" and that its principal interest is to ascertain whether rubber, principally synthetic rubber, is being allocated equitably. It has no intention, Shaver reported, of questioning the Administration's determination of stockpile requirements, or whether rapid accumulation of a large stockpile is justified by defense needs.

The issue which prompted the hearings boils down to the assertion by a number of small companies that the NPA is allocating a disproportionately larger share of new rubber to the major companies whose sales include original equipment tires to the automobile industry. They paint the picture as follows:

The new base periods announced to each consumer on February 19 by the Rubber Division places allocations almost entirely on a historical consumption basis—usage in the base period ended June 30, 1950. In this period major consumers enjoyed record sales of original equipment tires. This market has been and will be more severely curtailed as automobile production is cut back. The small users, chiefly small manufacturers of tires, contend that it is neither fair nor equitable to continue allocating limited supplies of new rubber according to a historical pattern that no longer reflects the industry's pattern of sales.

The Rubber Division has adopted, as of February 19, stricter standards for judging "hardship" appeals to increase a company's adjusted base period. These standards, some have contended, jeopardize the financial stability of small companies which installed new equipment, since NPA will not accept as hardship grounds the inability to use equipment installed after August 25, 1950, when R-1 was amended to curtail new rubber consumption.

These small consumers have buttressed their argument by citing the Rubber Act of 1948, as amended, which states that a competitive, expanding rubber goods manufacturing industry is essential to our defense.

NPA officials have declined advance comment on these assertions. They will explain the allocation program and answer all questions when they testify before the subcommittee on opening day. Secretary of Commerce Charles Sawyer, NPA Administrator Fleischmann, and Rubber Division Director Spencer are scheduled to open the hearings.

Unofficial sources, however, state that NPA has granted relief in genuine hardship cases; that no consumer has folded because of inadequate supplies of rubber; and that the real situation is that many small consumers, while receiving equal treatment to that accorded larger consumers, have suffered considerable cutbacks in February and March as compared to earlier months when hardship adjustments were granted more liberally.

Some of these cutbacks have exceeded 50% as a result of NPA's reexamination of each consumer's adjusted base consumption.

In a letter to all new rubber consumers, dated February 20, Spencer said: "Before making this review the NPA carefully considered the possible grounds under which a company might qualify for an adjustment of its base period. Standards for uniform treatment of all companies in like situations have been established.

"As a result of the reexamination, the NPA industry adjusted total base of new rubber hydrocarbon (excluding latex) has been reduced from over 1,430,000 long tons as of January 11, 1951, to 1,076,110 long tons as of February 19, 1951. This has the effect of increasing the industry's permitted consumption from 76% of the former base for March, 1951—as indicated in M-2 dated February 1, 1951—to 95% of the February 19, 1951, NPA adjusted base for that month. On the same basis, the permitted consumption of dry natural rubber for March would increase from 35% to 48%.

"The latex base has been adjusted upwards by NPA from the original base (July 1, 1949, to June 30, 1950) of 44,897 long tons to 51,020 long tons most of which is represented by new users or for new purposes so that in effect an increased usage over base period of 13.6% results for that industry."

The industry base for total new rubber, excluding natural latex, likewise was adjusted upward from 1,044,762, representing actual usage in the base period, to 1,076 110 tons. This included increases for dry natural rubber, adjusted from 606,985 to 622,579 tons, and for all synthetics, except Butyl, adjusted from 384,462 to 400,216 tons. The figure for Butyl rubber remained constant at 53,315 tons.

[Section 5 of M-2, as amended March 1, 1951, states that dry natural rubber consumption in any calendar month is limited to 48% of that for the adjusted base period. Applied to the 622,579-ton yearly figure for the whole industry, this means 298,837 tons of dry natural rubber a year may be used for civilian goods, and by difference, 777,273 tons of synthetic rubber, including Butyl.]

Spencer said the changeover to the new formula base will be made slowly enough to "facilitate an orderly transition to the new bases." NPA expects that the full effect of the redetermination will be felt in the July-September quarter. Spencer went on to explain that the provisions for adjustments and exceptions to these allocations will remain the same as in the past and that such applications will be acted upon by an NPA review committee using the same criteria as were applied in the redetermination of base periods.

Those applying for changes in bases were requested to note, among other things, the number of employes affected by the total new rubber consumed on July 1, 1949, January 1, 1950, July 1, 1950, and January 1, 1951.

The request for this information would appear to take cognizance of the fears of some companies that inadequate supplies of rubber would result in the loss of labor force. Spencer's predecessor gave cardinal importance to the operation of all consumers at a five-day, 40-hour week, in judging appeals for adjustments in allocations.

The Senate subcommittee, in its questionnaire of March 9, laid heavy stress on the impact of the revised, and generally scaled down, allocations on a company's work-week. It asked each consumer to note his average weekly hours of operation in November and December and in March. It also asked, "What percent of the normal 40-hour work-week, 3-shift operation does the base year ending June 30, 1950, consumption represent for your company?"

Among the complaints cited by some small firms is that the criteria adopted by NPA for judging hardship appeals for readjustment of base periods smack too much of a move toward almost complete reliance on historical consumption. The tough-minded adherence to those standards by the Rubber Division prompted them to turn to the Senate for help.

NPA Review Criteria

NPA officials make no bones of the fact that adjustments will not come easily. The criteria are set out in a six-page document entitled, "Rubber Division Operating Instruction No. 1 — Review of All Company Base Period Adjustments." This document sets out policy to guide reviewers in treating applications for adjustments.

Section five of this instruction cites six cases that do *not* represent abnormality in the base period, the usual ground for claiming "undue and exceptional hardship not suffered generally by others" in the industry. These cases are: shifts in important volume contracts such as loss of an important contract shortly before the base period; growth in volume of business over the base period or longer; added production resulting from the use of previously idle equipment or added shifts of operation; seasonal fluctuations; acquisition of a defunct business or merger of one with low base-period consumptions; introduction of a new product by an established rubber consumer, unless there is persuasive evidence that a substantial financial commitment had been made for the new product prior to August 25, 1950.

Section six denies adjustments to cases based on the claim that the industry was depressed in the base period, although the industry as a whole may merit adjustments on grounds of essentiality.

Section seven lists the cases that may qualify as abnormal base periods. These include companies shut down during the base period by extended labor disputes, fire, flood, or other catastrophe, continuing or recurring technical difficulties, or to permit plant conversion or shift to a new location. The latter two reasons for shut-

down are acceptable where there was larger than usual consumption of rubber in the months prior to the base period to build inventory in anticipation of the shutdown.

Businesses begun shortly before the base —between January 1, 1949, and June 30, 1949—may also be granted moderate adjustments. This section also provides adjustments for cases of "exceptional hardship, ordinarily financial, from requiring adherence to the base period. Most will involve," Spencer's instruction memorandum points out, "substantial investments to expand plant and equipment. If there is persuasive evidence that a substantial financial commitment had been made prior to August 25, 1950, which without a base adjustment would leave the company in a position of extreme hardship, an adjustment to receive the hardship is proper."

Section eight deals with determination of the amount of adjustment and reads, in part, as follows: "The first proposition is that the company should not be granted any base higer than it requested. It is to be recognized that many companies approach the problem of an application as a bargaining process; judicious analysis, often with consultation with industry technicians, can serve to reduce inflated requests. Experience in the months and year prior to the base period (but never after it) can serve as a guide in many cases. It is not intended, however, that bases reflect ideal conditions, and since most companies in the course of twelve months will have slack periods, minor shutdowns, and other events unfavorably affecting volume, it should be the endeavor of the reviewer to establish a level in line with conservative expectations, not the optimum."

Section eleven bears particularly on the situation encountered by a number of the companies who have brought their complaints to the attention of the Senate investigators. This section deals with treatment of businesses where redetermination of bases under this program may cause hardship. It reads:

"Any company that had received a very substantial adjustment which was largely or entirely canceled in the review is likely to face real hardship if required abruptly to cut back from an expanded level of consumption permitted by the adjustment. In dealing with such cases, the first step is to ascertain actual consumption from current reports in our statistical section, since some companies have not utilized their permitted allotments. Then, where it is found that a company in good faith expanded substantially as permitted, two possibiities exist: (a) Temporary hardship. Where a company has not made a substantial financial commitment, but where some labor dislocation and operational problems will cause temporary hardship, the NPA shoud not require immediate return to the base period. A period of not over three months should be allowed to effect readjustment in operations. (b) Extreme hardship associated with a substantial financial commitment made in good faith after being granted an adjustment. Where the commitment was in good faith the NPA must be very cautious about imposing a full 'rollback.' Evidence of a substantial financial investment and of operations undertaken in good faith are grounds for setting bases higher than otherwise would be justified. Caution should be exercised, however, to set the base only high enough to relieve the hardship, taking into account actual usage, the financial investment, and the nature of the company's business. Also, attention should be given to the effect given all companies by this base-period review program."

Spencer instructed the reviewers to prepare a list of all companies "where the result of the redetermination is to reduce the base figure by more than 50% from the company's base as it had been adjusted by previous action. This," he said "is for the purpose of handling the hardship cases referred to in section eleven."

Rubber Agency Organization

An organization framework for the GSA's Rubber Division was under consideration at that agency late in March. The plan under review would provide for four branches, as follows: purchasing, transportation, storage, and study and development.

Chain of command would lead from GSA Adminisrtrator Larson to Commissioner of the Emergency Procurement Service A. J. Walsh to Rubber Division Director John B. Ingle. George Casto, now acting deputy to Ingle, is soon to receive his appointment as deputy director.

GSA's rubber operation, since it expanded on January 1 to exclusive purchasing of imported rubber and distributer to the industry, has been staffed by some temporary assistants brought in from the trade and industry and some officials of the Emergency Procurement Service, whose area of responsibility extends to all stockpiled commodities.

J. J. Wolfersberger has been in charge of purchasing; Harold McElligott of layout (arranging deliveries to rubber consumers); Harold Flanick, statistics; Russell Voelker, inspection; Joseph E. Salisbury, transportation and storage; and Tom V. Wilder, research and development.

The official chart of the EPS shows that Salisbury and Wilder, in their respective fields, are division directors at the same level as Ingle. The plan under consideration would provide for separate handling of these areas for rubber under the Rubber Division of EPS.

Elsewhere, the establishment of more permanent organization is not so far along. NPA Rubber Division Director Spencer, is to have E. Dorrance Kelly as deputy director, filling the post held by Earl W. Glen until late January.

NPA has made a number of temporary appointments from the industry. Some will stay, and others will conclude their service shortly. When a more or less permanent organization chart, with personnel, is prepared, Spencer intends to give it wide distribution in the industry.

Kelly served most recently as deputy director of methods and planning at the Economic Cooperation Administration. During World War II he was a consultant to the WPB Controlled Materials Program Division. He came to ECA from the American Machinery & Foundry Co., where he served as a southern sales representative.

In response to inquiry, the Reconstruction Finance Corp. said it has no organizational chart of ORR and does not intend to draw one up. Rubber Reserve comes under the Office of Production, whose manager is George S. Oberfell. Assistant manager is James A. Reid. Executive director of Rubber Reserve is Gerald B. Hadlock; associate director is Leonard J. Ralston, and deputy directors are Samuel D. Morgan and Walter N. Munster.

Arthur Wolff has transferred from the National Security Resources Board to the Defense Production Administration, where he is in charge of the rubber area. DPA was created by Charles E. Wilson, head of the Office of Defense Mobilization. The principal function of DPA is to advise Wilson on coordination of policy and program of the various defense operating agencies, including NPA. DPA, whose administrator is Genl. Wm. H. Harrison, also has final responsibility for issuing rapid tax amortization certificates for industrial expansion.

NPA Chemical Order

The NPA established basic machinery for the allocation of chemicals through the issuance on March 16 of Order M-45. The order did not place any chemical under control, but provided the framework under which chemicals may be allocated.

The order provides comprehensive control, including inventory reporting and limitations. The most rigid of several alternate methods of allocation would require purchasers as well as suppliers to obtain NPA authorization to fill any order. For less critical chemicals, an alternate method would require the purchaser to certify the proposed end-use to the supplier, who must then obtain NPA authorization to fill the order.

Sulfur and sulfuric acid were reported to be the first chemicals likely to be made subject to M-45. Generally, the Chemicals Division of NPA would prefer to let industry establish informal distribution programs. The agency acknowledged that rubber processing chemicals are in tight supply, but declined to disclose whether these will be put under government allocation.

Synthetic Rubber Labeling

Representative James C. Davis (D., Ga.) introduced on February 22 a bill to provide for the labeling of products containing synthetic rubber. The measure, H.R. 2823, was referred to the House Committee in Interstate and Foreign Commerce, where no action has been scheduled at this date.

Text of the bill follows: "Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That (a) the Secretary of Commerce shall prescribe regulations requiring that no article containing, or composed in whole or in part of, synthetic rubber shall be transported between one State, Territory, possession, or the District of Columbia and another State, possession, or the District of Columbia in a form or state suitable for use by the ultimate user thereof unless such article is so labeled as to inform such user that it contains, or is composed in whole or in part of, synthetic rubber."

Benzene Supply

The Benzene Industry Task Group to the NPA recommended to that agency on March 19 that the government acquire some 9,000 tons of benzol from Western Germany through barter arrangement for American fuel blending ingredients. The industry representatives said they had tried unsuccessfully to barter for German benzol. Western Germany had demanded scarce sulfur in exchange.

The industry men advised against adopting government allocations for benzene, contending that voluntary arrangements adopted by the industry and based on a pattern of end-uses are working satisfactorily.

Meanwhile the Interior Department announced that certificates of rapid tax amortization have been granted to the Atlas Processing Co. to construct a

$2,600,000 benzene plant at Shreveport, La., and to Pan American Refining Co. to construct a $1,100,000 benzene plant at Texas City, Tex.

The Petroleum Administration for Defense reported that a certificate was granted to Phillips Petroleum Co. to construct facilities for the separation of isobutane at Borger, Tex. Estimated cost of the project is $4,056,575. Gulf Oil Corp. was authorized to take the rapid (five-year) tax write-off for a major portion of an $18,485,342 expansion project at Port Arthur, Tex., which includes some facilities for producing feed-stocks for aviation gasoline and synthetic rubber.

PAD did not indicate how much additional benzene will be produced from these additional facilities. Benzene producers and consumers had recommended that the government authorize facilities for the production of 88,000,000 gallons annually of synthetic benzene from petroleum.

Rome Rubber Conference

The ten governments, representing rubber producing or consuming nations, which met in London during February, have agreed to resume discussions of mutual rubber supply problems in Rome, just prior to the opening of the Rubber Study Group Conference in that city on April 16.

The two principal topics reviewed at the emergency meeting held in London during the two weeks beginning February 5 are again slated for discussion. At the London meeting the United States delegation, headed by Willis Armstrong of the State Department, endeavored to get assurances from Great Britain that shipments of crude rubber to Hong Kong, Communist China, and the Soviet Union would be curbed.

The London discussions also covered the prospect of negotiating an intergovernmental agreement providing for fixed quantity sales of natural rubber to the United States. The area of disagreement was the length of time such accord should run. The United States delegation proposed that any agreement terminate after one year, or no later than two years. The British delegation insisted on a longer term agreement, reportedly for five years. The discussions foundered on this point and did not move on to a consideration of possible fixed prices under an allocation scheme.

The official communique reported that the conference was called to consider supply problems through 1952, or the period in which the United States hopes to complete acquisition of natural rubber for its stockpile.

GSA has made some efforts, how serious has not been reported, to negotiate a fixed tonnage, fixed price contract with "first sellers"—the estates—of British Malaya.

Other Industry News

Collyer on Rubber Cartels

Inflation in the prices of raw materials used by the rubber goods industry will continue indefinitely if the United States Government enter into a rubber price cartel with rubber growing areas, or into fixed-price contracts with natural rubber producers, Collyer of Goodrich stated in a letter to Eric Johnston early in March.

Collyer suggested that Johnston call a meeting before March 14 in which "informed government and business people may join to consider the facts, to appraise them realistically and to stimulate action."

"This problem," he said, "is of immediate importance to our entire defense mobilization and economic stabilization programs."

Pointing out that the present world market price for natural rubber is about 80¢ a pound, an increase since January 1, 1950, of nearly 340%, Collyer reminded Johnson that, "today, the government bears almost total responsibility for the price of rubbers, both for the synthetic rubbers produced in government-owned facilities and for the natural rubber imported into this country. The total cost of natural rubber produced by reasonably efficient growers is about 10¢ a pound delivered in the United States. The average cost of all producers of natural rubber is probably not in excess of 16¢ a pound.

"The rubber position of the United States at present reflects the serious supply problems which we have faced in both natural and synthetic rubbers, resulting from the unprecedented levels of demand for rubber for current consumption, the scare buying of rubber products following war in Korea, the acceleration of buying for strategic stockpiling purposes, both by our government and other nations, failure of our government to maintain the output of synthetic rubber at levels recommended in 1948 and the government's delay in reopening synthetic rubber facilities which had been placed in mothballs at the close of World War II.

"Our company has frequently commented on the exorbitant cost to the American taxpayer of previous cartels in natural rubber organized by foreign governments, which have always resulted in extortionate prices to consuming countries, of which the United States is by far the largest. Long-time experience dictates that our government should not participate in any rubber price cartel or fixed price arrangements.

"It is our conviction that the world rubber supply situation is not nearly so serious as has been stated and is improving so rapidly that a much lower price for natural rubber will result within the next few months, provided our nation is not involved in a war with Russia, our government does not enter into price cartels with natural rubber producing nations or fixed-price arrangements with private producers, and that the adequacy of the nation's natural rubber stockpile, already accumulated, is realized.

"Great progress toward the solution of the rubber supply position has been made. Estimates show a world surplus of over 600,000 long tons of rubber this year, after all consumption needs for both military and civilian products have been filled.

"The 1951 world supply of new rubber will be by far the largest in history—2,800,000 tons. World consumption needs for both military and essential civilian rubber products in 1951 at 2,175,000 long tons are well within the limits of supply. The great current inflationary force in the natural rubber market is that of fear-buying of stocks, mainly for strategic purposes, as nations bid against each other for the 600,000 to 625,000 ton surplus.

"The performance of products made from American rubbers is constantly being improved. New types have been developed. Cold rubber is now in mass production and usage. New compounding materials have been discovered. New components are available. New techniques have been tested. The result is that American synthetic rubbers can now replace natural rubber much more effectively than during World War II.

"For these reasons the United States should by all means avoid entanglement in a rubber price cartel or in fixed-price agreements which would simply legalize and perpetuate much of the gross inflation now present in the natural rubber market structure to the continuing detriment of consumers, manufacturers and defense production, not only in the United States, but throughout the free world."

1950 Industry Finances

An interesting study of the financial reports of six Akron tire companies was presented by Joseph E. Kuebler in the March 11 issue of the *Akron Beacon Journal*.

It was reported that combined sales of these six companies soared to $2,254,270,000, an increase of $525,000,000 over 1949. Income from other sources such as fees, rents, and royalties added $14,000,000 more to their 1950 income.

A total of $1,331,617,000, or about 59% of this income, went for materials such as rubber, fabric and chemicals and various services.

A total of $578,197,000, or about 25.5%, was paid in wages and salaries.

Taxes of all kinds, both in the United States and abroad, but not including the excise taxes collected on tires, took $153,785,000, or nearly 7% of the money received.

Reserves — money set aside for emergencies—amounted to $21,553,000, or about 1% of income. Depreciation took $48,729,000, or 2%. Interest on debt amounted to $8,203,000.

Remaining was the combined profit of $114,054,000, which was nearly double the $59,941,000 profit of 1949, but was still only 5% of the 1950 sales. Out of the profit $36,573,000, or 1½%, was paid in dividends to the 97,173 stockholders many of whom are employes of the firms. The remaining $77,478,000 of the profit was retained in the company treasuries to provide more working capital and funds for future expansions.

RMA Reports

The Rubber Manufacturers Association, Inc., reported on March 13 that manufacturers' shipments of passenger-car tires during January were down 8.9% to 5,707,013 units from 6,263,058 units in December. Production of passenger tires also decreased in January, falling 3.6% to 5,433,309 tires from 5,635,980 tires the month before. With production lower than shipments, inventories at 2,748,482 units were 9.4% below the level of the previous month's end stocks of 3,032,539 tires.

Shipments of truck and bus tires in January were similarly lower, 4.2% to 1,254,477 units from 1,309,772 units in December; while production of truck and bus tires was up to 1,330,639 units from 1,175,150 units in December, an increase of 13.2%. Inventories totaled 803,384 units, an increase of 9% from the December 31 figure, 737,190 units.

Shipments of automotive inner tubes were up in January to 6,595,079 units, an increase of 2.7% from December, when 6,422,987 tubes were shipped. Production was off 2.6% to 5,950,266 units, as compared with 6,111,421 units the month before. Inventories of tubes were down 11.4% to 5,852,488 units from the 6,608,314 units on hand at the end of December.

Earlier in the month the RMA re-

ported that new rubber consumption in January increased 7.5% to 103,585 tons from the 96,319 tons consumed in December.

Consumption of natural rubber in January was up 1.3% to 44,857 long tons from the 44,290 tons used in December. Use of synthetic rubber amounted to 58,728 tons, an increase of 12.9% from the 52,029 tons during the previous month.

In January the use of GR-S reached 47,424 tons against 41,091 tons in December. Similar figures for neoprene were 3,761, against 3,684; for Butyl, 6,270, against 6,053; and for nitrile types 1,239, against 1,201 long tons, respectively.

Labor News

After two meetings in February between representatives of the United Rubber Workers of America, CIO, and government rubber officials in Washington on the subject of new rubber use restrictions and their effect on employment, the union blamed both the rubber goods manufacturers and the government for the layoffs of many workers and reduced hours for many others.

The industry was criticized for "undisciplined use of rubber" during the latter part of 1950 in the face of government warnings that the supply of rubber would be reduced and the government was accused of "ineffective policing" of the industry.

The charges were contained in a statement drafted by representatives of the international union and the nine Akron, O., local unions, following a meeting of the matter.

During the meetings with government rubber officials, the union argued that dislocation of thousands of highly skilled workers by layoffs would be much more serious to our national security than borrowing a small amount of rubber for the next few months.

The URW also announced during March that it intends to make new economic demands on the rubber industry. L. S. Buckmaster, president of the union, said in this connection:

"Our people are entitled to receive the full benefit, not only of wage allowances provided for in the recent order of the Wage Stabilization Board, but also an additional amount to make up for the terrific rise in living costs."

The union in the Fall of 1950 was granted wage increases by major rubber companies averaging 12¢ an hour, which on a percentage basis varied from 6% to 8%. The WSB order issued February 16, 1951, limited wage increases to 10% over rates existing January 15, 1950. Under the WSB formula, rubber workers generally would be free to seek additional increases of between 2% and 4%. According to the Buckmaster statement, however, it would seem that the union demands would be in excess of such amounts.

The URW executive board endorsed unanimously the United Labor Policy Committee's recent withdrawal of support of the mobilization program. The board took this action in a meeting in Washington on March 10.

The top governing body of the rubber union said it was in agreement with the ULPC "in condemning the selfish domination of the mobilization program by the interests of big busines."

"Some months ago," the board said, "organized labor submitted a program whereby all Americans would share the burden of a defense economy. This program called for fair price and rent control laws, equitable tax legislation, just manpower controls and genuine wage stabilization. These recommendations have been largely ignored, however.

"A major share of the blame for this situation must rest on the last Congress, which passed the unworkable and inequitable Defense Production Act."

The board said that labor representatives on the Office of Defense Mobilization walked out "because they did not believe in the policies that had been established and because they did not want to be a party to the legalized swindle taking place.

"These policies which forced labor to protest are not unfair to labor alone. These policies punish every segment of our economy, with the exception of large corporate interests."

Firestone Votes Modified Union Shop

Workers at the Akron plant of the Firestone Tire & Rubber Co. voted 5 to 1 in mid-March in a National Labor Relations Board supervised election in favor of a modified union shop.

The vote was the outgrowth of contract negotiations conducted between the URWA and the company last fall in which the company agreed to a modified union shop. Elections on this matter will probably be held in other Firestone plants.

Goodyear Contract Negotiations

Negotiations between Goodyear Tire & Rubber Co. and the URWA on a new working conditions contract, which have been in progress since January 9, were stalemated in March on the issue of a union shop for all Goodyear employes. Other items which were also reported as contributing to the stalemate were incentive rates, the company's demand that the new contract be for two years, and the wage issue. The previous contract between Goodyear and the union expired on February 19, but the agreement has been continued during the negotiations.

Fred Climer, Goodyear vice president in charge of industrial relations, issued the following statement on March 10, after negotiations were temporarily suspended:

"After 50 days of negotiations between representatives of the management and of URWA, a stalemate has been reached and meetings have been recessed without any date fixed for their resumption.

"Practically every issue involved in renegotiating the company-wide contract had been tentatively resolved except the issue of the union shop.

"On this issue the union demanded full union shop provisions which makes union membership compulsory for all employes within the bargaining unit. Thus, failure to maintain membership in good standing would result in the affected employe losing his job.

"The company offered to accept the modified form of union shop which is now in effect at the plants of two competitors, Firestone and Goodrich.

"Under the modified union shop all employes now in the union would be required to continue their memberships for the duration of the contract and all new employes would be required to become members of the union within 45 days of their employment at Goodyear and maintain such membership for one year thereafter.

"Employes not now members of the union would have the right to abstain from membership if they so elected.

"On Friday (March 9) in Cincinnati where the negotiations have been in progress, neither side was willing to change its position on this issue and the sessions were suspended."

On March 19 it was announced that the Akron local union had authorized a strike vote if a contract agreement with the company was not reached within a week. Negotiations were resumed in Cleveland, O., on March 18.

EAST

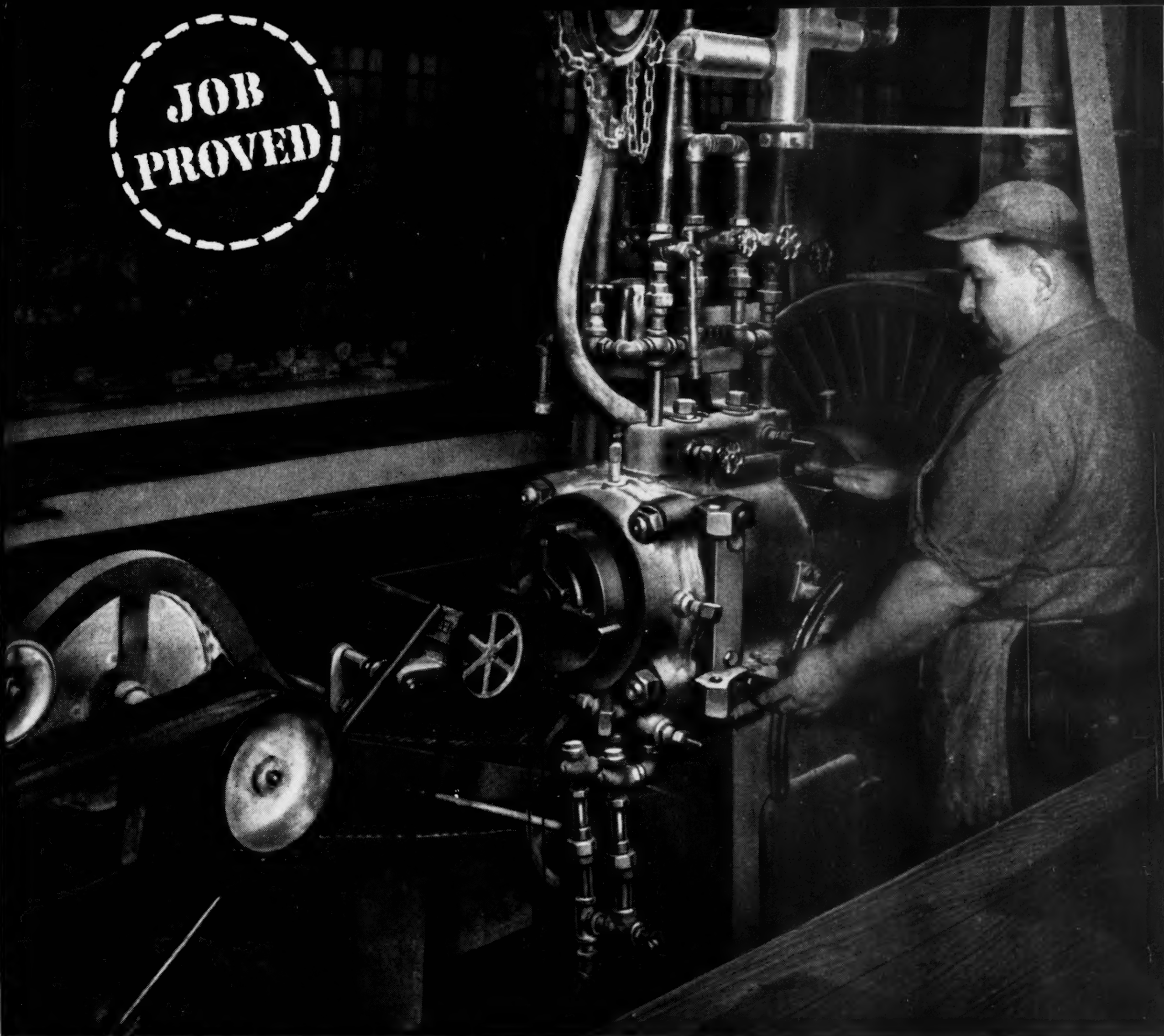
New du Pont Film Shown

"The Du Pont Story," a 72-minute technicolor motion picture reviewing the history of the 149-year-old company, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., was given a press showing on February 27 in New York, N. Y. Filmed in California and at numerous du Pont plants, the motion picture has a cast of 225 Hollywood actors and actresses in addition to Walter S. Carpenter, Jr., and Crawford H. Greenewalt, company board chairman and president, respectively, who play their own roles. The film highlights the history of the company from its beginning in 1802, using the administrations of du Pont's 10 presidents as convenient chapters for telling the story. Included in the film are the development of such products as "soda powder" blasting agent, Duco lacquers, rayon, cellophane, and nylon. The cast includes Eduard Franz, Sigrid Gurie, Stacy Keach, Donald Woods, Lyle Talbot, and Tom Neal.

Neoprene Airdry Coating

Neoprene can now be applied as an air drying protective coating for industrial maintenance work on structural steel, concrete, wood, and exterior surfaces of tanks and equipment. Produced by Gates Engineering Co., Wilmington, Del., under the name, Gaco Neoprene Maintenance Coating, the material is applied by brush or spray gun and develops its desirable physical properties without benefit of heat. The product is a 40% solids solvent solution of a specially developed neoprene composition, does not gel or set-up in the container, and cures at normal temperatures after the solvent has evaporated, it is also claimed. Because of the inherent stability and resilience of neoprene, the coating is particularly applicable where intermittent contact with liquids or constant exposure to corrosive fumes creates problems too severe for the best types of bituminous or oil-base industrial paints. The resilience of the coating eliminates the danger of cracking and peeling caused by vibration, distortion, or thermal expansion and contraction of the structure to which it is applied.

Christopher Trading Corp., 2 Broadway, New York 4, N. Y., recently was formed to import and deal in natural and synthetic rubber. Adrien H. Alcan is manager, and James J. Meenan, assistant manager.



REJECTS DUE TO SCORCHING ELIMINATED

Circo Light Rubber-Process Aid Reduces Internal Heat in Stocks; Improves Plasticization, Simplifies Extruding

If rubber is plasticized right, it will extrude into tube form without scorching. But to find the perfect plasticizer is easier said than done. One well-known manufacturer of mechanical rubber goods experimented with a great many rubber-process aids before he discovered what he was looking for. Not one of them could prevent the neoprene from scorching, and the losses through rejects ran high.

The problem was solved by Circo Light Rubber-Process Aid, recommended by a Sun technical man. By properly conditioning the stock, making it easier to work, this "Job Proved" Sun product speeded up the extruding process, and prevented scorching. Operating speeds increased. Quality improved. Rejects dropped to a minimum. And whites did not stain. The company has been using "Circo" for many years now with excellent results on neoprene, reclaim, and GR-S stock.

Circo Light Rubber-Process Aid is not an ordinary petroleum-base oil. It is a "Job-Proved" petroleum-derived process aid made under precisely controlled conditions specially for rubber compounding. It has a high degree of naphthenicity and its composition is held to such close limits that there is minimum danger of getting varying results in production.

For full information about any of Sun's Rubber-Process Aids, call or write the nearest Sun Office.

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G-E Appointments

Everett S. Lee has been appointed editor of *General Electric Review*, monthly engineering magazine published by General Electric Co., Schenectady, N. Y. Mr. Lee, who succeeds Edward C. Sanders, who retired recently after serving since 1926 as executive editor of the publication, formerly was executive engineer of the G-E general engineering laboratory in Schenectady. Besides his editorial duties Mr. Lee will continue his active work in professional engineering and engineering educational circles.

Clyde E. Albro has been appointed sales development supervisor for mica products, with headquarters in Schenectady. Mr. Albro came to the company's apparatus department in 1942, joined the chemical department at its formation in 1945 as a sales representative in Philadelphia, and in 1948 was transferred to the Pittsburgh office where he worked as sales representative until his present appointment.

Robert G. Boulter, of the chemical department, has been appointed manager of sales planning and analysis for the laminated and insulating products division, with headquarters at Coshocton, O. Mr. Boulter joined the company in 1948 on the sales training course. Since that time he has specialized in the sale of G-E Textolite industrial and decorative laminates in the Cleveland and the Chicago areas.

Earl F. Arnett has been put in charge of the Pittsfield chemical process development section of the chemical department. Mr. Arnett joined G-E in April, 1940, as a chemist in the research section of the new products development laboratory. In 1945 he went to the chemical engineering section of the laboratory and the following year became a chemical engineer for the process development section of the engineering division. In February, 1949, he was named supervisor of pilot-plant operations for that section.

The appointments of Robert L. Teeter as manufacturing engineer and Alfred R. LaCasse as manufacturing analyst for the chemicals division of the chemical department also were announced recently.

Mr. Teeter was formerly a chemical project engineer for Tennessee Eastman Corp.

Mr. LaCasse started with G-E in 1943 as an operating engineer in the phenol plant, ultimately becoming a process engineer. In June, 1949, he was assigned to a project entailing special economic studies. Since November, 1949, until his present appointment he was a process engineer for the resin, varnish, and compound plant.

Vernon R. Childress has been appointed manager of sales analysis and planning for the chemicals division of the chemical department. Mr. Childress has been with G-E since last July, when he joined the marketing division at Pittsfield. In 1940 he had started with the B. F. Goodrich Co., where he worked in many fields, from research to materials control and in 1945 was appointed to sales service and later to sales. In October, 1947 he went to O'Sullivan Rubber Co. as manager of plastics sales.

K. O. William Sandberg, of the chemical department, has been appointed manager of the industrial engineering section. He has been with G-E since May, 1950, when he was named a supervisor in the methods and equipment laboratory. In August, 1950, he was made industrial engineer for the chemical department's manufacturing division. Prior to coming with the company, he had been chief industrial engineer for the Albany Felt Co. for two years. His industrial career also includes work as a time study engineer for Anaconda Wire & Cable Co. and as a research engineer for confidential naval work for New York University.

Walter C. Welsh has been appointed communications and training manager of the employee relations division of the chemical department. He had been with the planning department of Bendix Corp., then spent three years in the Navy. Next he became vice president of Cohesive Co., Inc., and two years later joined the sales division of General Latex & Chemical Corp.

Joseph C. Mogavero has been appointed facilities engineer of the manufacturing division of the chemical department, assigned to organics, plastics, and laminated products. Mr. Mogavero started with the company in July, 1946, as a mechanical engineer at the phenol plant, and in June, 1949, went to Schenectady as Glyptal alkyd resin plant engineer, where he has been until his present appointment, which brings him back to Pittsfield.

The chemical department has also announced a new West Coast organization, according to James R. Patterson, West Coast chemicals division manager. Figuring in the announcement are Joe B. Holmes, Henry C. Nelson, and Harry S. Komer. All three men will maintain offices at the department's plant in Anaheim, Calif., which manufactures G-E Glyptal alkyd resins used in paints.

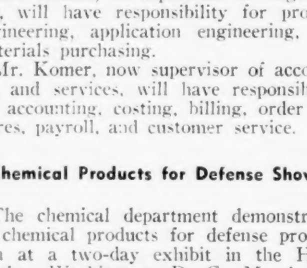
Mr. Holmes, named supervisor of manufacturing, will have responsibility for manufacturing, process engineering, maintenance, quality control, safety, and employe and community relations.

Mr. Nelson, as supervisor of engineering, will have responsibility for product engineering, application engineering, and materials purchasing.

Mr. Komer, now supervisor of accounting and services, will have responsibility for accounting, costing, billing, order and stores, payroll, and customer service.

Chemical Products for Defense Shown

The chemical department demonstrated its chemical products for defense production at a two-day exhibit in the Hotel Statler, Washington, D. C., March 6-7.



© Fabian Bachrach

John M. Bierer

More than 800 persons attended the exhibit, which was designed to acquaint government civilian and military personnel with the department's products and services. According to R. L. Gibson, general manager of the department, some 2,400 square feet of display space were used to exhibit and demonstrate G-E silicones, plastics molding materials, protective coatings, electric insulating materials, molded plastics, and industrial and functional laminates. G-E Vice President E. E. Potter acted as host for the company, and invitations were sent to civilian and military personnel in the Washington area responsible for specification and procurement of defense materials.

Stein, Hall & Co., Inc., 285 Madison Ave., New York 17, N. Y., importer, manufacturer, and distributer of burlap, starches, tapioca flour, adhesives, food products, and other commodities, recently elected to its board of directors John C. Daly, vice president and manager of the burlap department, and David McGill, president of Stein-Hall, Ltd., Toronto 4, Ont., the firm's Canadian subsidiary.

Daniel H. Lipman has been named assistant general sales manager. He was formerly manager of the New York sales office and is succeeded as such by Edwin A. O'Neill, manager of Stein, Hall's St. Louis Office. Edwin M. Clevan has been promoted to associate manager at New York.

Rohm & Haas Co., Resinous Products Division, Philadelphia, Pa., has appointed Carl B. Bennett to its field staff in the Ohio area. Working out of Cleveland headquarters, he will complement George T. Sohl in sales and development work with the companys' Paraplex polyester resins and plasticizers, Amberlite ion exchange resins, and resins for the rubber industry. Mr. Bennett was formerly with Catalin Corp.

Bierer Named President

Boston Woven Hose & Rubber Co., Cambridge, Mass., on March 5 held a special election to fill the vacancies created by the recent death of President J. Newton Smith. John M. Bierer was named president; Harold B. Richmond, first vice president; and Marshall B. Dalton, a member of the board of directors.

Mr. Bierer, who in January was made executive vice president, started with the company in 1911 as a chemist. He won several promotions to become technical superintendent, then assistant factory manager, and, in 1929, factory manager. He was elevated to the vice presidency in 1944. Mr. Bierer has also been a director of Boston Woven Hose since 1932.

He was born in Virginia and was graduated from Washington & Lee in 1908 and from Massachusetts Institute of Technology in 1910. Then he spent a year at the latter institution as an instructor.

Mr. Richmond, who was graduated from MIT in 1914, has been a director and a member of the executive committee of the rubber concern for some time.

Mr. Dalton is president of the Boston Manufacturers Mutual Fire Insurance Co. and of the Mutual Boiler & Machinery Insurance Co.

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Plastic Plants Made from Ameran Plastisol

Plastic Plants

Plastic plants that actually duplicate the leaf and steam structure of such decorative plants as Chinese Evergreen, Philodendron, Aspidistra, and Caladium, are being manufactured by Plastic Plants Co., Cleveland, O., for use as interior decorations in homes, restaurants, offices, theatres, night clubs, etc., in place of natural blooms. Available in more than 190 varieties of flowering plants and ferns, the plastic creations are hand made to conform in detail, coloration, and texture to living flora. Made from Ameran plastisol, a product of American Anode, Inc., Akron, O., the plastic plants are not affected by heat up to 175° F., are fire repellent, impervious to acids, solvents, greases, and alcohol, and are completely washable, it is claimed. As shown in the accompanying illustration, the plastisol plants provide attractive vegetation decorations without the problems of cleaning up fallen leaves, watering, and replacement of natural plants which may die.

Whittaker, Clark & Daniels, Inc., 260 West Broadway, New York 13, N. Y., continues to distribute marine magnesium products: magnesium carbonate, magnesium oxide, magnesium hydroxide under the trade mark names of Maglite and Hydro-Magma for the new Marine Magnesium Products division of Merck & Co., Inc.

General Latex & Chemical Corp., Cambridge 39, Mass., recently added to its organization Everett C. Eldredge and Daniel I. Livingston. The former will work on the development of shoe cements and paper adhesives; while the latter, on the research staff, will direct work on the polymerization of synthetic rubber.

Mr. Eldredge for 14 years was with A. G. Walton Co., shoe manufacturer, and was responsible for the manufacture of latex adhesives and leather finishes. He has also served as a consultant on shoe adhesives to several other companies.

Dr. Livingston during World War II was an instructor in the United States Army Air Force. He has also been an instructor at St. Francis College and the Polytechnic Institute of Brooklyn.

Pequanoc's Golden Jubilee

Fifty years ago the late Joseph F. McLean founded on the banks of the Pequannock River in Butler, N. J., what was destined to become one of the world's leading rubber reclaiming plants. Pequanoc Rubber Co. was incorporated on June 8, 1901, and submitted its first samples to the trade in October of that year. By November, 1902, increasing demands for Pequanoc reclaims necessitated the first of many increases to the plant, which originally had a daily capacity of 4,000 pounds of reclaimed rubber.

Today's modern plant, which has 360,000 square feet of floor space, has a daily capacity of 224,000 pounds, including pan, acid, and digester types of reclaim. Besides the company has available a generous capacity for custom compounding, custom grinding, and reclamation of plastic materials.

To manufacture this large amount of rubber Pequanoc uses three million kilowatt hours of electricity monthly to supply power for 250 motors, which in turn drive more than 100 heavy-duty rubber mills and other equipment. Rubber scrap in the form of old tires, tubes, etc., totaling 250,000 pounds a day, is used; 2,000 gallons of water per minute is required for processing, and 1,700,000 pounds of steam is generated daily by four boilers of 2400 hp. to supply the steam requirements.

Well-equipped and staffed laboratories and pilot plants are maintained where there is continuous control of product as well as constant development and testing of new materials and processes.

Reclaim, under the famous Indian head, Pequanoc, is shipped to all parts of the United States, Canada, Cuba, South America, and many European countries.

Sun Wins Navy Contract

Sun Rubber Co., Barberton, O., has been awarded a contract for research, development and final production of a bellows-type torpedo retriever made of rubber. Navy officials have expressed complete satisfaction with tests of this retriever conducted at Piney Point, Md., and attended by T. W. Smith, Jr., and C. C. Lile, Sun president and factory manager, respectively. Similar to a collapsible drinking cup and performing in much the same manner, the retriever floats the torpedo head, thus enabling it to be retrieved for reuse, with consequent savings in money and critical materials. The mold used to produce the retriever weighs 7,000 pounds and is one of the largest ever installed in Sun's plant.

Clifford J. Collins has been named plant engineer at Sun, and Frank A. Stefanski has been made head of Sun's vinyl development department.

Collins brings to his new post almost 25 years' experience in the rubber field. Before joining Sun, he was associated with The General Tire & Rubber Co. for 23 years, including service as chief engineer.

Stefanski came to Sun early in 1950 as foreman of the casting department. For the 12 previous years he had served as factory superintendent of the Wooster Rubber Co. His background also included six years with Seamless Rubber Co. and six years with C. F. Church Co.

Baldwin-Lima-Hamilton Corp. has closed its office at 120 Broadway New York 5, N. Y., and has coordinated all sales activities in the New York area at the offices at 60 E. 42nd St., New York 17.

(Upper Right) **Original Plant of Pequenoc Rubber Co.;** ***(Lower Photo)*** **Present Plant of the Company**

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Scott, Nelson Advanced

Robert D. Scott, Jr., plant manager of the large polyvinyl chloride resin plant at Louisville, Ky., has been appointed general manager—production for all plants, it was announced by B. F. Goodrich Chemical Co., 324 Rose Bldg., Cleveland 15, O. John L. Nelson will succeed Scott as plant manager at Louisville. Nelson had been production manager of the plant.

Joining The B. F. Goodrich Co. in 1935, Scott worked first as a chemist in the rubber reclaim division. He was transferred to the chemical plant in Akron in 1936 as a chemical engineer on polyvinyl chloride resin development, then in 1940 to Niagara Falls, N. Y., as manager of the company's first vinyl resin plant. When the Louisville Geon plant was completed in 1942, he was sent there as plant manager.

Scott, in his new post, will be in charge of production for all plants of the company, including Louisville and Niagara Falls Geon plants; Port Neches and Institute, W. Va., synthetic rubber plants; Avon Lake general chemicals plant; and the Akron, O. chemicals plant.

Nelson came to the Goodrich organization in 1939 as a chemist in the rubber reclaim division and was later transferred to the chemical plant in Akron, where he worked on the early development of Geon polyvinyl chloride resin. When the Niagara Falls Geon plant was completed in 1940, Nelson was sent there as shift foreman. In 1942 he moved to the Louisville Geon plant, where for four years he served as general foreman and in 1946 was appointed production manager.

Goodrich Chemical has moved its Chicago sales office to Suite 1124, Board of Trade Bldg., West Jackson Blvd., Chicago 4, Ill. Occupancy of new quarters provides additional office and conference space required by expanding operations. The Chicago sales office has been in the Field Bldg. since 1947.

Goodrich Chemical also maintains sales offices in Boston, New York, Louisville, and Los Angeles.

Product Developments

A tough, long wearing, non-woven fabric that looks, feels, and absorbs water like chamois, but wears three times longer, will soon be introduced in selected test areas. Called X-Lint, the fabric is impregnated with Hycar latex, a product of Goodrich Chemical. Samples of X-Lint are said to have successfully withstood hundreds of car washings and the harmful effects of gasolines, greases, and powerful detergents. The new material, made by Loren Products Corp., is said to be unaffected by ordinary household chemicals and solvents that are generally harmful to chamois, leaves no lint, and possesses none of the noticeable disadvantages of natural chamois, such as thin spots or ragged ends.

Wear and tear on refrigerator door gaskets will be practically eliminated, it is expected, by the use of gaskets made from Geon plastic, a product of Goodrich Chemical, on 1951 Westinghouse refrigerator models. Until recent increases in the cost of crude rubber, vinyl gaskets were slightly more costly than rubber refrigerator gaskets, but their indicated life was many times greater. Now vinyl gaskets will mean savings to home owners in gasket replacement cost and refrigerator operating cost. Unlike rubber, the vinyl gaskets retain their resiliency and do not crack under normal conditions and are unaffected by solvents, greases, waxes, household chemicals, and even perspiration from human hands, it is claimed. Whereas a rubber gasket must be replaced every one year to five years because of deterioration resulting in a poor refrigerator door seal, 10-year tests of the vinyl gaskets showed no deterioration or need of replacement.

Two new types of sealing tape, utilizing Geon polyvinyl resin made by Goodrich Chemical, have been introduced by Technical Tape Corp., New York, N. Y. The first, a water-and moisture-proof tape, was designed primarily for use in sealing packages for overseas shipment and meets government specifications JAN-P-127 and AN-T-12A. A contract for 60,000,000 yards of this tape has been received by Technical Tape from the Army Ordnance Department. This pressure-sensitive, waterproof cloth tape is also available for civilian use in olive drab, white, and black colors. The second product is "Break-Pruf" tape, which can be used to replace metal strapping in such heavy-duty operations as wrapping coils of wire or metal stripping, and banding plate glass, rods, tubing, etc. Consisting of a paper backing reinforced with longitudinal glass fibers, this tape is said to have excellent tear resistance, tensile strength, and adherence.

Robert D. Scott, Jr.

Asphalt Tile Institute recently elected the following officers: president, Julien O. Heppes, director of sales, Tile-Tex division, Flintkote Co.; vice president, Winthrop Brown, Jr., general manager, flooring sales division, The B. F. Goodrich Co.; and treasurer, Seymour Milstein, secretary-treasurer, Mastic Tile Corp. of America.

The New Jersey Zinc Co., 160 Front St., New York 7, N. Y., at a board meeting February 28 elected R. L. McCann president to succeed Henry Hardenbergh, elected chairman of the board. Mr. Hardenbergh became president of the company in 1943, after serving for many years as vice president. Mr. McCann, formerly general manager of mines of the company, was appointed assistant to the president in January, 1949, and was elected a vice president in March, 1950. Other officers of the company were reelected.

Dewey & Almy Expanding

Dewey & Almy Chemical Co., Cambridge, Mass., plans expansion of facilities at its Acton, Mass., plant to meet the increased demand for special synthetic rubbers, copolymers, special resins, and plasticizers. The company further announced that last year it developed an improved separator for use in standard automobile and industrial storage batteries, and if production of this item in a pilot plant now being completed reveals no unexpected problems, Dewey & Almy plans to build a full-scale plant.

Stockholders of Dewey & Almy at the annual meeting March 12, approved offering stockholders two shares of a new $1 par common stock, of which 1,500,000 shares were authorized, in exchange of each share of the no par common now held. There are 356,949 shares of no par common currently outstanding.

The company will have far greater sales and earnings in the first quarter of 1951 than in the same period for 1950, Bradley Dewey, president, told the meeting. The company manufacturers chemical specialties for industry which have a wide diversification of uses and are largely essential in war or peace, said Mr. Dewey, adding that business is excellent and indications are that sales for the first half of this year may well be in the neighborhood of those for the last half of 1950, which amounted to $13,255,366.

Bradley Dewey, Jr., in New Post

Election of Bradley Dewey, Jr., as vice president of Dewey & Almy in charge of the Cryovac Division was announced March 20. Dr. Dewey has been in charge of Cryovac operations since last August. The division, which has a plant in Lockport, N. Y., and another under construction at Cedar Rapids, Iowa, manufactures Cry-O-Rap plastic bags for packaging frozen meat, poultry, fish, and smoked and treated pork products.

Graduated from Harvard in 1937, and M.I.T. in 1940, Dr. Dewey, who organized the company's product development, has been with Dewey & Almy since his return from the Armed Forces in 1945.

Carborundum Co., Niagara Falls, N. Y., soon will occupy new sales office and warehouse buildings in Euclid, O., and Bristol, Pa. The buildings, identical in design, are of modern, single-story construction; each has a total floor space of 35,000 square feet, of which 32,000 will be used for warehouse purposes. Each building also will have a refinishing department, making it possible to alter abrasive wheel dimensions and thus supply a greater percentage of customer requirements from stock and provide faster service on emergency orders.

A. G. Spalding & Bros., Inc., Chicopee, Mass., this year is celebrating its seventy-fifth anniversary. The firm was founded in 1876 in Chicago, Ill., by the well-known pitcher, Albert G. Spalding. Among the "firsts" claimed by the company during its successful career are: production of the first American-made football; manufacture of the first American-made tennis balls; production of the first domestic golf ball; design and production of the world's first basketball.


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Defense Effort Affects Toy Fair

The material shortages and other problems posed by the defense program on the toy industry were clearly evident at the annual American Toy Fair, held in New York, N. Y., March 5-16. Comparable in size to last year's record breaking show, the Fair included exhibits by some 1,200 companies covering over eight floors in the Hotel McAlpin, seven floors at the Hotel New Yorker, and permanent showrooms at 200 Fifth Ave., 1107 Broadway, and other locations. Registration was estimated at about 10,000, also equivalent to last year's attendance, but there the resemblance ended.

While exhibitors last year displayed an extremely optimistic outlook, the companies showing this year all expressed doubt and uncertainty as to the toy industry's expectations for the year. In one way or another most executives agreed that toy production levels would be kept high, but many items would be discontinued or substituted in materials to avoid critical items. While at first glance the exhibits displayed the customary profusion of products, sizes, colors, and styles, many items were already unavailable or in very short supply; while others have been discontinued in an effort to consolidate and conserve raw materials.

The retrenchment effort was very prominent among the rubber exhibitors, where many lines were no longer in production, but being sold from stock; while other lines showed reductions of up to 50% in sizes and colors. As in previous years, plastics items were prominently displayed, but, here again, except for the vinyl processors, the problem of material shortages threatens wholesale curtailment of production. Another noticeable feature of the rubber and the large plastics exhibits was the dearth of new products as a further result of the material conservation program undertaken by the manufacturers. Most rubber and plastics exhibitors reported that firm orders were being taken only for immediate or nearby delivery by June 30.

Among the rubber exhibits, Anderson Rubber Co. displayed balls, balloons, and latex toys; Auburn Rubber Corp. showed cars, farm sets, and other toys made from rubber-reclaim mixtures; and Bayshore Industries, Inc., featured masks, puppets, balloons, and latex toys. Playballs and doll skins made of neoprene were shown by Dewey & Almy Chemical Co.; balls, balloons, and latex toys, by Eagle Rubber Co., Inc.; latex toys and dolls, by Eastern Rubber Specialties Co.; and paddle balls, sponge balls, and balloons, by Fli-Back Sales Corp. Rubber horseshoe sets and quoit games were exhibited by Martin Rubber Co.; sponge rubber toys were shown by Miracle Toy Corp.; and rubber molding sets by Model Craft, Inc. Latex toys and balls, featuring the new Kaysam Kuties, dolls with swivel-mounted vinyl heads on stuffed latex bodies, were shown by Molded Latex Products, Inc. The balloons and latex toys exhibited by Oak Rubber Co. included the new Flying Saucer balloons, and Alice in Wonderland toss-up balloons. Pioneer Rubber Co. had a wide range of balloons, as did Ryan Rubber Co. The doll, animal, and ball toys of Seiberling Latex Products Co. featured the new junior sport balls with built-in valves, a rubber-cork centered baseball with molded rubber cover, and a new series of Rubber Guard household mats and trays. Sun Rubber Co. showed dolls, balls, and latex toys; while balls, balloons, and a new series of vinyl plastisol crib toys were set up by Tillotson Rubber Co., Inc. Masks of all types were modeled by Topstone Rubber Toys Co., Inc.; while Van Dam Rubber Co., Inc. displayed balloons, including new silver colored styles.

Vinyl inflatables, such as wading pools, swim rings, beach balls, beach mats, boats, and other toys were shown by Bilnor Corp.; Doughboy Industries, Inc.; Clarvan Corp.; Kestral Corp.; Plastic Heat Sealing Co.; Plastic Innovations, Inc.; Plastictronics, Inc.; Plastikaire Products, Inc.; Urb Plastics Corp.; and U. S. Fiber & Plastics Corp. U. S. Fiber also featured new waist-high waders made of 20-gage film with one-piece feet and electronically sealed seams. Among the other exhibits of interest were displays by some 30 plastics molders and more than 60 doll manufacturers.

Rappoport Studios

Newton L. Nourse

Brown Promotes Nourse

The appointment of Newton L. Nourse to the newly created position of general sales manager of Brown Co., producer of wood cellulose, with mills at Berlin, N. H., and LaTuque, P.Q., Canada, was announced March 14 by Downing P. Brown, vice president in charge of sales. Mr. Nourse was promoted from manager of the pulp sales division.

He joined the company in 1920 following graduation from Colby College and in 1925 organized the technical service department for the pulp sales division and also organized the sales inspection departments for both plants. In 1933, Mr. Nourse became manager of the pulp sales division. His new responsibilities include supervision of pulp, paper, towels, shoe inner soles, fiber pipe, conduit, and chemical sales divisions.

John J. McDonald succeeds Mr. Nourse as pulps sales manager. The former became an employe of Brown's research department in 1927 following graduation from the University of New Hampshire. As a research chemist (1927-1930) he was identified with the development of Brown specialty pulps in the chemical and papermaking fields. Between 1930 and 1932, he was associated with Mr. Nourse in the technical service department of the pulp sales division. Mr. McDonald next was promoted to pulp sales representative in the New York regional territory, which took place in June, 1932. He served in this capacity until entering the U. S. Army Chemical Warfare Service in November, 1942. Following his release from the Army in November, 1945, he returned to Brown Co. as assistant manager of the pulp sales division.

New Firm Erecting Factory

Construction is to start immediately on a $550,000 precision rubber molding plant for Berea Rubber Co., Berea, Ky., recently incorporated subsidiary of The Parker Appliance Co., Cleveland, O. The 30,000-foot plant will essentially duplicate the Cleveland rubber facilities of Parker, source for precise aircraft seals molded of the company's specially formulated compounds to meet extreme performance requirements.

Scheduled for full operation within six months, Berea Rubber will relieve the near-overload condition of Parker's Cleveland rubber division. Annual output of the new plant will be valued at $1,500,000, with provision for expanded capacity as needed.

The plant will be erected on a 9¼-acre plot approximately one mile east of the center of Berea. Initial employment will be 130 persons.

Ross & Roberts, Inc., Stratford, Conn., has announced the availability of 0.0017-inch thick calendered unsupported vinyl film as its most recent accomplishment in an intensive program for developing lightweight films. The announcement states that this is the first time that 1.7-gage calendered unsupported vinyl film has been offered on a commercial scale. In the experimental stage for several months, manufacture of the thin film was finally made possible by new developments in calendering techniques and equipment and follows the company's development of a two-gage product. Of particular interest to the packaging and the protective materials fields for both military and civilian applications, the new development makes it possible to enjoy the economy of a thin film while retaining the advantages of a calendered product. Available in a variety of colors and widths, the new film is being distributed by Ross & Roberts Sales Co., Inc., 350 Fifth Ave., New York, N. Y.

American Tile & Rubber Co., Trenton 2, N. J., has announced that Amtico rubber flooring installed at the Central Pier in Atlantic City, N. J., shows no wear after constant pounding by more than 200,000 persons over a two-year period. The rubber tile flooring was installed two years ago in the pier's Model Homes Exhibit.

In a report to the company, Louis St. John, general manager of the pier, wrote, "Amtico has been on the floors for the past two years and there is absolutely no wear from the very heavy traffic, which is many times greater than it would receive in the average home."

The Amtico flooring in a variety of designs was used throughout a two-bedroom model home at the pier.

Sets Up Fabric Fellowship

A participating fellowship for study of the two-dimensional, stress-strain properties of airship and mechanical goods type of fabrics has been established at Textile Research Institute, Princeton, N. J., by The Goodyear Tire & Rubber Co., Akron, O.

J. H. Dillon, director of research of the Institute, said the experiments made possible by the fellowship will not be limited to conventional types of fabrics, but will extend to yarns made of various fibers.

Initial phases of the research will be conducted by C. H. Reichardt, supervised directly by Dr. Dillion.

The participating fellowship plan of the Textile Research Institute permits the donor to suggest a field of fundamental research to be undertaken by the graduate student, supported by the fellowship. Donation is $5,000 a year for a period of two years.

All results of the research are publishable. The donor firm has the privilege of consultation with the participating Fellow and his thesis adviser. No restrictions as to future employment are placed upon the graduate student conducting the study.

Slusser Safety Awards

Presentation of awards in the Goodyear World-Wide Slusser Safety Contest, now in its twenty-fifth year, were made on February 5 in ceremonies at the Goodyear Theater, Akron. First prize in the contest for the Slusser Memorial trophy was won by the company's tubes and accessories division, Plant 1, Akron, with 1,350,000 man-hours worked without a lost-time accident. Second place was won by Pathfinder Chemical Corp., which had 160,000 man-hours worked without a lost-time accident. Third place for the Slusser Trophy, as well as first place for the newly established George Hinshaw Trophy for Foreign Plants, went to Goodyear Gummi Fabriks Aktiebolag, Norrkoping, Sweden, which had a record of 1,083,000 man-hours worked with only two accidents reported. The Slusser Cotton Mill Banner was awarded to Goodyear Cotton Co. of Canada, Ltd., St. Hyacinthe, P.Q., which had 1,893,000 man-hours worked with only four lost-time accidents.

Radio Program Again Honored

Having received the highest award in radio from the Freedoms Foundation at Valley Forge last year, the Goodyear sponsored radio program, "The Greatest Story Ever Told," repeated this year by receiving the Foundation's Honor Medal Award for 1950 for its outstanding contribution to the American way of life. The award was made by General Omar N. Bradley at Valley Forge on Washington's Birthday. Now in its fifth year of broadcasting, the program is heard every Sunday afternoon from 5:30-6:00 p.m. EST over the ABC network and gives dramatic presentations of the teachings of Christ.

Personnel Promoted

Bruce W. Wert, sales promotion staffman for Goodyear, has been placed in charge of advertising media, according to J. K. Hough, director of advertising. Wert succeeds R. D. Firestone who recently resigned. Wert now will handle Goodyear's contacts with publishers' representatives and also will supervise the company's advertising schedules in magazines, newspapers, trade papers, and other forms of advertising media.

A member of the Goodyear organization since 1937, he has been in the sales promotion department since 1944. Prior to his present appointment he had been handling promotions on products of the tire sales department. He has also supervised shoe products and mechanical goods advertising and sales promotion. Following a short period of training as a squadron member, Wert served in the printing & paper products, sales and sales accounting departments before transferring to sales promotion.

Britton O. Shaffer, Jr., a staff squadron trainee since July, 1950, has been appointed to the sales promotion staff. He will handle general department assignments and some of the duties formerly the responsibility of Wert.

Thomas W. Kirkwood, Jr., member of the wholesale field operating staff at Goodyear's home offices, has been appointed Salt Lake City district operating manager. He replaces William T. Goodwyn, now San Francisco and Sacramento district credit manager, a new post.

A. G. Morrill, senior staffman in Goodyear's dealer department, has been named director of the company's soil conservation awards program, succeeding J. T. Kearny, Jr., who is now assistant store manager trainee at San Francisco.

A. B. Cluman, of Goodyear's Pliofilm sales department, has been granted a leave of absence to accept a post with the National Production Authority at Washington, D. C. He is in charge of films and plastics in the Packaging and Container Section.

Product Developments

Previously used as a sole, heel, and innersole material for the shoe trade, Neolite will soon be manufactured on a mass-production basis for the luggage, handbag, and accessories industries, according to Harry L. Post, general manager of Goodyear's shoe products division. Increased manufacturing facilities at the company's Windsor, Vt., and Gadsden, Ala., factories will soon make possible large-volume production of Neolite in continuous strips up to 72 inches wide; whereas the material was formerly made only in sheet form. These strips can be cut, skived, split, scored, grooved, beveled, stitched, and colored as desired. Neolite has the appearance and flexibility of leather, but is waterproof, outwears leather, does not crack or dry out, and comes in uniform qualities, it is claimed. According to Post, any product now made of Neolite can be priced considerably lower than a similar product fabricated of leather. Finished Neolite is being furnished to luggage and accessory manufacturers by Barash Co., Inc., New York, N. Y., which has done much work on the use of the material in such products as luggage, sport bags, brief cases, watchbands, billfolds, camera and optical cases, children's cowboy holster and belt sets, etc.

Shoulder Bag and Luggage Made of Neolite

A new-type fuel tank, said to be the largest ever built, is being manufactured by Goodyear for the long range B-36 bomber. The tank holds 3,000 gallons of fuel and consists of a Pliocel nylon fuel cell weighing less than 0.085-pound per square foot which fits into a metal shell. The tank has passed "slosh" tests at the Air Materiel Command center at Dayton, O., and has undergone calibration tests at the Fort Worth, Tex., division of Consolidated Vultee Aircraft Corp., where the bombers are built.

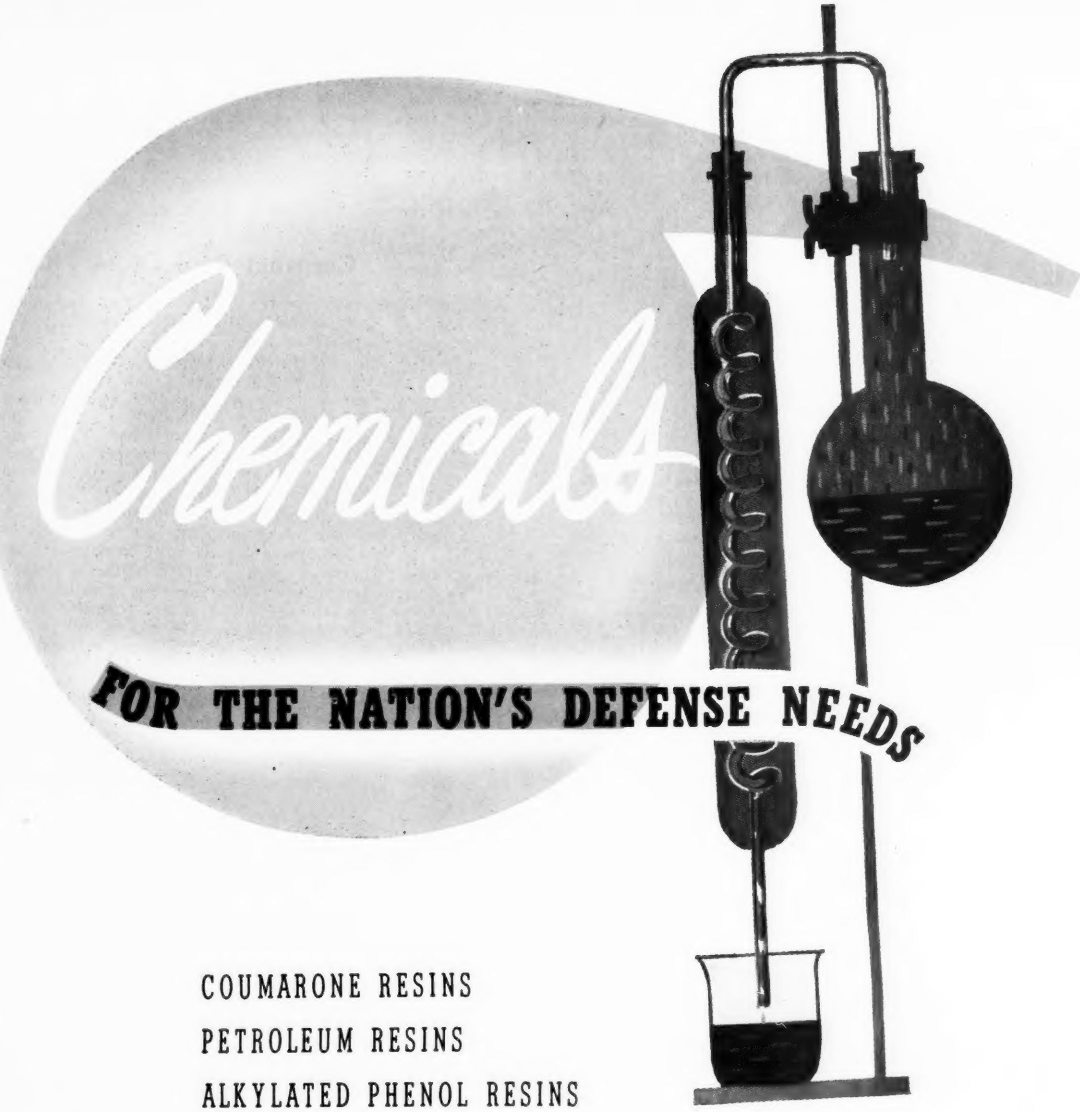
Seiberling Rubber Co., Akron, O., has appointed Thomas K. Morgan office manager of the Philadelphia district sales office to replace A. A. Fuller, who retired March 1 after 25 years on the job. Morgan joined Seiberling as a shipping clerk in 1946. Previously he had worked for Linde Air Products and the Midwest Booking Co.

Firestone Tire & Rubber Co., Akron, O., will operate the Ravenna Arsenal, Ravenna, O., one of the Army's largest shell and bomb loading plants during World War II. Preliminary agreement for this operation has been made by the Army Ordnance Corp., and the tentative date for Firestone to assume operating responsibility is April 1. Staffing of Firestone personnel for the arsenal is now under way. Several months ago Firestone made a survey of the work needed to reactivate the arsenal and presented an industrial mobilization planning report to the Ordnance Corps. Since then Firestone personnel have been working with Ordnance officials in preparing the arsenal for reactivation.

Foster D. Snell, Inc., firm of consulting chemists and engineers, 29 W. 15th St., New York 11, N. Y., recently officially opened the new offices and laboratories of its Supplee division at Bainbridge, N. Y. The new building, completed late in November, 1950, is the first of four structures planned at Bainbridge by the company.

Snell also recently added to its technical staff Wm. Kanninen, A. Haldane Gee, and Irving Seidenberg.

Baker Castor Oil Co., 120 Broadway, New York 5, N. Y., has developed a line of new products, metallic ricinoleates. Barium, cadmium, calcium, magnesium, and zinc ricinoleates are now available. Pilot-plant samples may be obtained upon request, and larger amounts for experimental production runs can also be supplied if required. Regular production in volume of the new products is expected in the near future. Preliminary studies of these ricinoleates indicate that they equal or surpass the performance of metallic stearates in their many applications.



COUMARONE RESINS
PETROLEUM RESINS
ALKYLATED PHENOL RESINS
PLASTICIZING OILS
COAL-TAR SOLVENTS AND OILS
NEUTRAL AND SHINGLE STAIN OILS
RUBBER RECLAIMING OILS
CHEMICAL SPECIALTIES

THE NEVILLE COMPANY **NEVILLE** PITTSBURGH 25, PA.

Plants at Neville Island, Pa., and Anaheim, Cal.

A39

Changes at Goodrich

The B. F. Goodrich Co., Akron, O., recently announced the following changes among its personnel.

A. Clarke Mack, Jr., has been named manager of flat belting, including conveyer, elevator, and transmission, industrial products sales division. He succeeds J. Robert Thompson, now manager of the Atlanta district for the division, where he takes the post from Art Coffin, who has retired after company service going back 35 years.

Mack joined Goodrich in 1940 and has been in industrial products sales all that period. For the last year he was in sales promotion work on flat belting.

Thompson, with the company since 1930, started in the textile division at the Martha Mills, Silvertown, Ga., and has been in industrial products sales 17 years except for four years in the U. S. Army Ordnance Corps.

George L. Marchant has been named manager of the Boston district of the replacement tire sales division to succeed L. L. Black, who retired after having held the post since October 1, 1930. Marchant has been with the Goodrich company for 12 years.

Gilbert F. Stenger has been named fleet sales manager of the truck tire sales department, succeeding Howard F. Kidwell, transferred to Detroit, Mich., in the company's automotive, aviation, and government division. Stenger joined Goodrich in 1934, and among his sales posts has been the managership of the companys' Miami, Fla., retail store. For the last three years he was assistant manager of accessories sales.

Harold W. Delzell, section manager, field engineering department of the Goodrich company's tire division, has been elected president of The Tire & Rim Association, Inc., Tower Bldg., Akron, O.

The DuBois, Pa., plant of the Goodrich company, of which Carl J. Phillips is manager, has received a citation from the Department of Labor & Industry of Pennsylvania for a perfect safety record during 1950. This is the third consecutive year in which the plant has won the award.

"High Flotation" Tire

A new "high flotation" tire which helps keep military trucks from bogging down in mud or sand will soon be standard equipment on Army tactical trucks, according to J. E. Gulick, Goodrich general manager of tire manufacturing. The new tire is better suited for the low-pressure operation needed for mud and sand service than the wartime general-purpose tire, and use of increased air pressure to the normal level permits the new tire to perform like conventional tires on paved roads. The new design is said to have resulted from three years of research and development conducted by the Army Ordnance Corps and the rubber industry through its Tire & Rim Association Ordnance Advisory Council. With lowered air pressure the high flotation tire presents a broader base at ground contact than conventional tires and, therefore, keeps on top of sand and mud better. A special tread design provides traction for general-purpose trucking, yet digs less into mud and sand. It was pointed out that the new tire will put an additional strain on available crude rubber supplies since the only way to get high flotation is to use a larger tire to carry the same loads now carried by conventional tires.

M. G. O'Neil Advanced

The board of directors of The General Tire & Rubber Co., Akron, O., on March 7 created the new office of executive assistant to the president and unanimously approved the appointment of Michael Gerald O'Neil to the new position. General's new official, a 29-year-old former United States Air Corps pilot, took over his new assignment immediately.

The board designated the duties of the new office as primarily "to carry out the policies of the president." M. G. O'Neil also has the responsibility of coordinating finance, operations, and sales.

M. G. O'Neil, youngest son of W. O'Neil, company president, received his B.S. degree from Holy Cross College in 1946, following his honorary discharge from the Air Corps. He joined General following graduate work in Harvard's Business School and has been connected with the company's treasurer's office, foreign plant operations, and plastics divisions. He was elected to the company's board at the thirty-fourth annual stockholders' meeting on April 4, 1950.

Melvin L. Hurr has been named manager of factory personnel at General Tire. Hurr, who has been with the company 25 years, succeeds John J. Loge, recently appointed director of employe services. First employed at General as a band builder, Mr. Hurr soon became a band room foreman and in 1930 was made general foreman of the factory services department. He has been with the personnel department since 1941.

WEST

Wyandotte Expansion Plans

A two-pronged expansion program, designed to increase both its manufacturing capacity and breadth and its technical service activities, has been announced by Wyandotte Chemicals Corp., Wyandotte, Mich., through President Robert B. Semple. In addition, the program will include significant growth in the company's research and development work, with emphasis on the development of new products. The program will involve the chemical plants at Wyandotte, the limestone quarries at Alpena, Mich., the clay operations at Blue Mountain, Miss., and the compounding plant at Los Angeles, Calif.

The planned program will not only increase the ouptut of the company's three basic chemicals, chlorine, soda ash and caustic soda, but also those of other chemicals made, with special emphasis in the organic field on detergents and cleaning compounds. Among these materials, chlorine capacity will be increased 220 tons a day, soda ash output will increase by 20%, and production of sodium carboxymethyl cellulose will be doubled. The initial phases of the program, to be carried out within the next 24-36 months, will be followed by additional projects to keep the expansion on a continuing basis.

Ground already has been broken in Wyandotte for a new research pilot-plant and the Wyandotte research center. The latter, expected to be ready for occupancy in mid-1952, will house all the firm's scientific and technical groups under the supervision of T. H. Vaughn, vice president-research and development. A two-story structure about one and one-half city blocks long and a half block wide, the center will be functionally engineered to handle specific types of research. These augmented facilities will also enable the company to increase its technical services to consumers.

Contract with Coast Plant

A recently signed contract by which Inland Rubber Corp., Chicago, Ill., a subsidiary of The Mansfield Tire & Rubber Co., Mansfield, O., provides certain managerial and technical services to the Pacific Tire & Rubber Co., Oakland, Calif. The transaction also provides for possible acquisition by Inland of a one-half interest in the Pacific company if and when certain government restrictions are relieved, according to James H. Hoffman, secretary-treasurer of the Inland company.

The Oakland plant has a capacity of 4,500 tires a day. It is of considerable importance as a means of obtaining defense production and for meeting growing transportation problems of tires, camelback, and tire repair materials, arising out of expanded overall defense requirements.

No change in the present executive personnel of the Pacific company is expected. Heading the executive staff are Earl W. Booz, executive vice president; Harry A. Wright, vice president and sales manager; Wesley H. DeSellem, vice president and treasurer, and John B. Condrey, secretary.

Mansfield Retires

Harold R. Mansfield, president of Pioneer Rubber Mills, San Francisco 11, Calif., retired March 1 after 46 years of continuous service. He had joined Pioneer in 1905, when the company was operating under the predecessor name of Bowers Rubber Co. Both the factory and the offices were in San Francisco at that time.

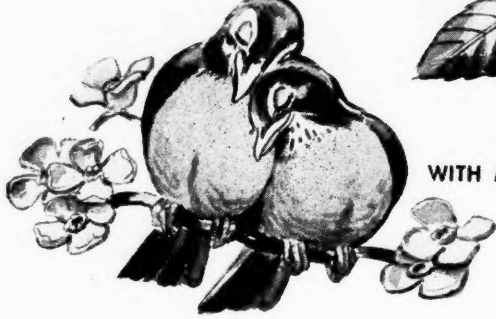
Mr. Mansfield first worked in the factory shipping department and advanced through sales and production to the position of vice president in charge of production in 1920. He was Pioneer's top production man at the Pittsburg, Calif., factory for many years, became executive vice president in 1935, and president in 1946.

Following Mr. Mansfield's retirement, W. S. Towne was elected president at Pioneer. Other officers of the company are: H. F. Hotle, executive vice president and secretary; F. W. Swain, vice president, production; S. M. Suhr, vice president, sales; F. J. Burnett, treasurer and assistant secretary; and R. VonSchmidt, auditor.

Opens Chicago Office

Emery Industries, Inc., Carew Tower, Cincinnati 2, O., has discontinued the services of its Chicago representative, Clarence Morgan, Inc., and opened a direct sales office at 221 N. LaSalle St., Chicago, Ill. The rapid development of specialized products requiring technical sales and service through direct sales coverage is indicated as the reason for the change.

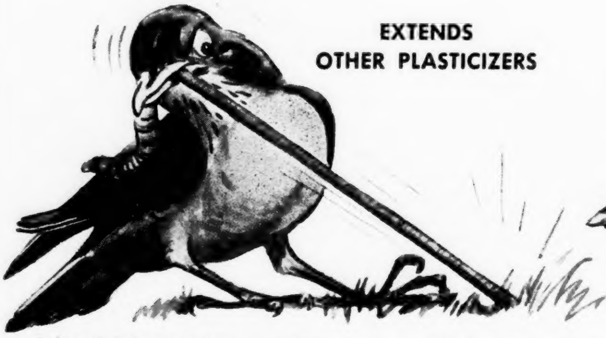
For Small Plasticizer Bills



COMPATIBLE WITH MOST COMPOUNDS

WON'T MIGRATE FROM FINISHED PRODUCT

EXTENDS OTHER PLASTICIZERS



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Process Products

E. G. Hibarger, Cincinnati district manager, has been named Chicago district manager in charge of the new office. D. R. Robertson, specialty sales representative in the Chicago area, and A. R. McDermott have been appointed to the Chicago district as chemical sales representatives.

The district to be served by the new sales office includes northern Illinois, northern Indiana, Wisconsin, Minnesota, and northern Iowa.

OBITUARY

Ernest W. Beck

AFTER a long illness, Ernest W. Beck, 65, supervisor of safety of United States Rubber Co., New York, N. Y., died March 11 in Rockville, Conn. Funeral services were held at the Mann & Mann Funeral Parlors, Boston, Mass., on March 14, followed by burial in Forest Hills Cemetery, Boston.

Mr. Beck was born in Birmingham, England, but at the age of three he and his family came to this country and settled in Boston. He studied to become a manual training and mechanical drawing instructor and also took special courses in engineering and insurance at Cornell, New York, and Columbia universities.

The deceased, for about 14 years, was an instructor in Boston, Trenton, N. J., and Cambridge, Mass., schools, and also organizer and director of manual arts in Nashua N. H., public schools, and then principal of the New Hampshire school for training drafted men. During World War I he served as superintendent of training at one of the training centers for the United States Shipping Board Emergency Fleet Corp.

In June, 1920, Mr. Beck joined U. S. Rubber as executive assistant to the president of U. S. Tire Co., in charge of industrial relations and safety at the company's general offices in New York. In 1923 he was appointed director of safety and in 1925 was made supervisor of safety.

An organizer of the Greater New York Safety Council, the Metropolitan chapter of the American Society of Safety Engineers, and the Veterans of Safety, the deceased was also a member-at-large of the National Safety Council.. In addition, he was a member of the Methodist Episcopal Church, of Leonia, N. J., and a 32nd degree Mason.

Surviving Mr. Beck are the widow, two daughters, and three brothers.

Arthur F. Keenan

ARTHUR F. KEENAN, 64, Chicago sales representative for the mechanical goods division, United States Rubber Co., died March 11 after suffering a cerebral hemorrhage. He started with the company in 1919.

Mr. Keenan served in the Marine Corps in World War I. He was a member of the American Legion, B.P.O.E., and a founder member of the Society of Grain Elevator Superintendents.

He is survived by his wife, two daughters, two sisters and a brother.

Funeral services were held March 14.

NEWS ABOUT PEOPLE

Kenneth C. Crouse

George F. A. Stutz

J. L. Cochrun, Jr.

Kenneth C. Crouse has been appointed administrative assistant to R. H. Eagles, vice president of the industrial products department of J. M. Huber Corp., 100 Park Ave., New York 17, N. Y. Mr. Crouse will supervise the department's statistical sales records and will be in charge of its advertising and publicity. He will also act as office manager and personnel director. Mr. Crouse was formerly vice president of the sales division of the Warren McArthur Corp.

Herbert E. Smith, chairman of the board of U. S. Rubber, heads the manufacturing group for the April Cancer Crusade.

Walter A. Henson, of Dow Chemical Co., was the guest speaker at the March 5 meeting of the Chicago Paint & Varnish Production Club. His topic was latex paints.

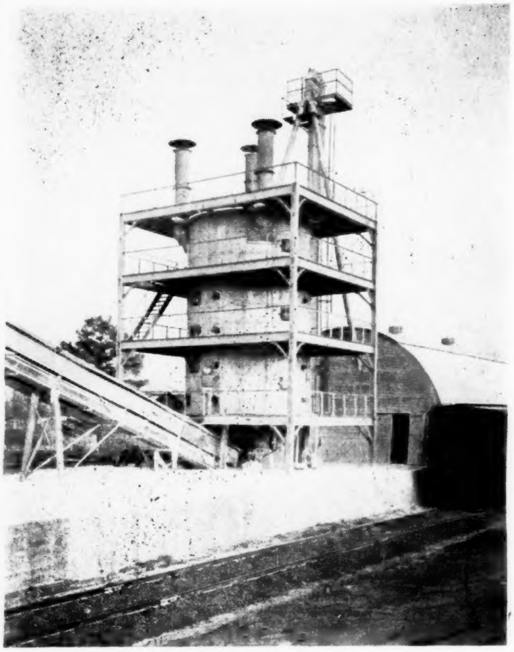
George F. A. Stutz has been named manager of the research department of The New Jersey Zinc Co. (of Pa.), Palmerton, Pa., succeeding E. H. Bunce, now assistant to the president, with headquarters in New York. Stutz started with N. J. Zinc in 1922 and has been active in all phases of the companys technical programs since that time. During World War II he served as a civilian adviser to the Office of Scientific Research & Development. He is also the author of a number of papers in the field of pigment and paint, ultra-violet absorption and transmission, particle size measurements, and luminescent pigments.

Elliot H. Simpson, of E. H. Simpson & Co., Inc., New York, N. Y., has accepted the chairmanship of the rubber committee for the 1951 finance campaign of the Greater New York Councils, Boy Scouts of America.

G. N. Vacca, of Bell Laboratories, Inc., Murray Hill, N. J., has been made a member of the Wire & Cable Technical Committee of the Industry Operations Bureau, National Production Authority.

H. H. Pact has joined Glyco Products Co., Inc., Brooklyn 2, N. Y., as a technical representative for the New England district, with headquarters at 64 Lindy Ave., Providence, R. I. Previously Mr. Pact had spent several years with E. F. Drew & Co., Inc. as manager of the textile department and later as district manager in New England of the technical products division. Mr. Pact will use his experience in chemical applications in a program of development with Glyco.

J. L. Cochrun, Jr., has been appointed vice president and managing director of The Dayton Rubber Export Co., Dayton, O., to succeed Col. E. L. Hallowell, resigned. Widely experienced in the rubber export field, Mr. Cochrun has traveled extensively in 64 foreign countries. A wartime lieutenant colonel, he also served as liaison officer with the Chinese Army in Burma and China.



World's largest calcining furnace for production of anhydrous kaolin pigments. (U. S. Pat. No. 2307239).

FINANCIAL

Allied Chemical & Dye Corp., New York, N. Y. For 1950: net income, $41,-212,520, equal to $4.65 a share, contrasted with $37,150,977, or $4.19 a share, in 1949; sales and operating revenues, $408,042,-285, against $363,743,806.

American Cyanamid Co., New York, N. Y., and wholly owned subsidiaries. For 1950: consolidated net earnings, $33,739,-401, equal to $8.99 each on 3,597,344 common shares, contrasted with $16,149,513, or $5.28 each on 2,798,584 shares, in 1949; net sales, $322,338,188, against $237,-730,655.

American Zinc, Lead & Smelting Co., Columbus, O. For 1950: net profit, $3,-802,808, equal to $5.14 each on 673,100 common shares, contrasted with $573,915, or 35¢ a share, the year before; sales, $62,-511,857, against $33,326,802; federal income and excess profits taxes, $3,275,000, against $30,000.

Columbian Carbon Co., New York, N. Y. For 1950: net profit, $6,149,161, equal to $3.81 a share, compared with $5,-955,247, or $3.69 a share, a year earlier; sales, $48,680,481, against $38,691,178; taxes, $4,500,000, against $2,515,000.

Dewey & Almy Chemical Co., Cambridge, Mass. For 1950: net earnings, $1,-936,056, a new high, equal to $6.05 each on 319,949 common shares, compared with $3.05 a share in 1949; net sales, $22,258,-857, another record, against $16,297,002.

Diamond Alkali Co., Cleveland, O. For 1950: net income, $4,829,620, equal to $4.45 a share, against $3,042,298 or $2.80 a share, in 1949; net sales, $55,702,-575, against $48,430,652.

E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., and subsidiaries. For 1950: net income, $307,601,913 (a new high), equal to $6.59 a common share, compared with $213,672,141, or $4.52 a share, a year earlier; net sales, $1,297,-473,345 (another peak), against $1,024,-775,280; federal income taxes, $223,630,-000, against $116,780,000.

Eagle-Picher Co., Cincinnati, O., and domestic subsidiaries. Year ended November 30, 1950: net profit, $2,929,296, equal to $3.25 a share, compared with $2,747,-147, or $3.09 a share, in the preceding fiscal year; net sales, $69,123,902, against $63,349,822.

Farrel-Birmingham Co., Inc., Ansonia, Conn. For 1950: net profit, $1,346,717, equal to $4.21 a common share, against $910,291, or $2.84 a share, in 1949; net sales, $17,277,344, against $15,776,293.

Flintkote Co., New York, N. Y. Twelve months to December 31, 1950: net income, $7,703,255, equal to $5.83 a common share, compared with $5,825,579, or $4.33 a share, the year before; net sales, $83,879,811, a record, against $67,-815,156; taxes, $7,082,612, against $3,590,-469.

Koppers Co., Inc., Pittsburgh 19, Pa. For 1950: net income, $11,615,498, equal to $6.81 each on 1,617,125 common shares, contrasted with $7,111,997, or $4.03 a share, the year before; net sales, $212,-397,177, against $191,386,841; income taxes $11,296,262, against $4,892,756.

Monsanto Chemical Co., St. Louis, Mo., and subsidiaries, except British and Australian ones. For 1950: net profit, $26,-220,333, equal to $5.37 each on 4,704,216 common shares, contrasted with $17,236,-422, or $3.74 each on 4,276,051 shares, the year previous; sales, $227,135,206, against $165,924,700.

General Electric Co., Schenectady, N. Y. Year ended December 31, 1950: consolidated net earnings, $173,423,702 (a new high), equal to $6.01 each on 28,845,-927 capital shares, contrasted with $125,-639,051, or $4.36 a share, in 1949; net sales, $1,960,429,446 (another record), against $1,613,563,611; federal income taxes, $196,718,000, against $78,000,000; provision for depreciation, $51,214,000, against $47,499,000.

General Tire & Rubber Co., Akron, O., and subsidiaries. Twelve months to November 30, 1950: net profit, $8,557,616, equal to $13.88 each on 586,419 common shares, compared with $1,014,883, or 94¢ each on 587,419 shares, in the preceding fiscal year; net sales, $125,375,737, against $92,579,553; federal income taxes, $7,160,-800, against $600,000; current assets, $54,-155,665, current liabilities, $15,263,906, against $45,931,581 and $10,910,098, respectively, on November 30, 1949.

The B. F. Goodrich Co., Akron, O., and subsidiaries. For 1950: net income, $34,708,355, equal to $24.19 a common share, contrasted with $20,935,738, or $14.36 a share in the preceding 12 months; net sales, $543,312,294 (a new high), against $387,918,386; provision for reserves, $4,000,000, against $5,000,000; income taxes, $45,370,000 against $14,210,000; current assets, $215,587,281, current liabilities, $43,664,123, against $188,279,971 and $28,205,699, respectively at the end of 1949.

Goodyear Tire & Rubber Co., Akron, O., and subsidiaries. Year ended December 31, 1950: net profit, $35,109,355, equal to $15.62 each on 2,065,303 common shares, compared with $20,230,520, or $8.40 each on 2,065,411 shares, in the preceding year; net sales, $845,138,051 (a new high), against $633,505,978; income taxes, $48,-894,366, against $17,934,947; current assets, $355,971,277, current liabilities, $66,-859,872, against $303,289,558 and $41,244,-522, respectively, on December 31, 1949.

Mt. Vernon-Woodberry Mills, Inc., New York, N. Y. Year ended December 31, 1950: net income, $2,225,078, equal to $6.91 a common share, compared with $1,-477,020, or $3.87 a share, in the preceding year.

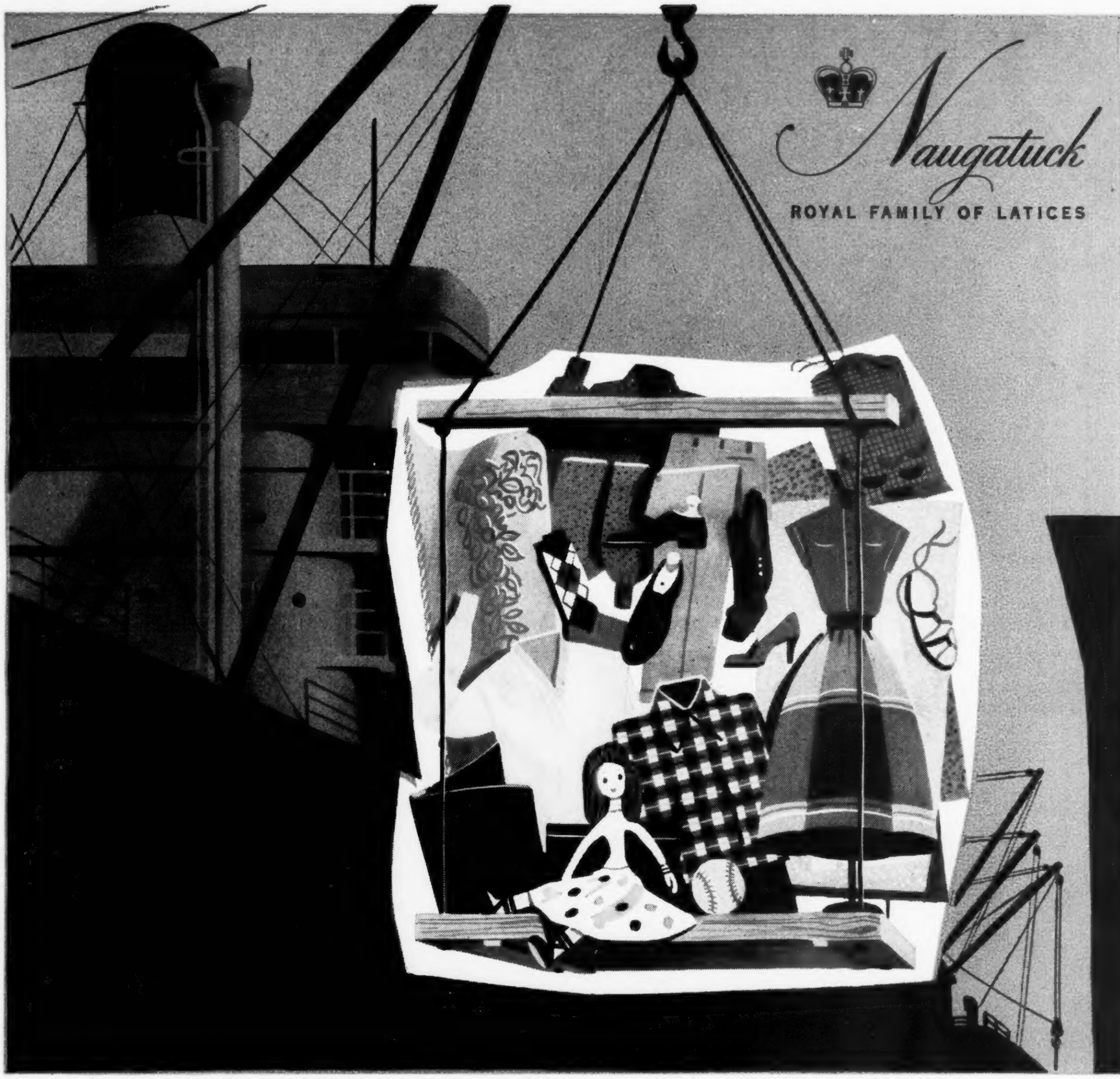
National Lead Co., New York, N. Y. Twelve months to December 31, 1950: net earnings, $26,490,644, a company record and equivalent to $7.23 a common share, compared with $14,749,011, or $3.88 a share, in the preceding year; sales, $342,-727,911, another high, against $257,461,-599.

National Rubber Machinery Co., Akron, O. For 1950: net income, $335,821, equal to $2.18 a share, against net loss of $31,332 in 1949; net sales, $5,196,587, against $3,717,721.

Pittsburgh Plate Glass Co., Pittsburgh, Pa. Year ended December 31, 1950: net income, $42,928,748, a new high and equal to $4.64 a share, contrasted with $38,135,088, or $4.22 a share, a year earlier; sales, $337,186,034, another record, against $281,462,159.

Dividends Declared

Company	Stock	Rate	Payable	Stock of Record
Armstrong Rubber Co.	A & B	$0.25	Apr. 2	Mar. 16
	Pfd.	0.59⅜ q.	Apr. 2	Mar. 16
Athol Mfg. Co.	Com.	2.00	Dec. 26	Dec. 19
Baldwin Rubber Co.	Com.	0.15 q.	Jan. 25	Jan. 15
Boston Woven Hose & Rubber Co.	Com.	0.50 q.	Feb. 26	Feb. 15
Collyer Insulated Wire Co., Inc.	Com.	0.30	Feb. 1	Jan. 19
Converse Rubber Corp.	1st Pfd.	1.00 accum.	Jan. 6	Jan. 3
Crown Cork & Seal Co., Inc.	Com.	0.25	Feb. 28	Feb. 8
	Cum. Pfd.	0.50 q.	Mar. 15	Feb. 20
Crown Cork & Seal Co., Ltd.	Com.	0.50 q.	Feb. 15	Jan. 15
DeVilbiss Co.	Com.	0.25	Jan. 20	Jan. 10
Detroit Gasket & Mfg. Co.	Com.	0.25 q.	Jan. 25	Jan. 10
Dunlop Tire & Rubber Goods Co., Ltd.	1st Pfd.	0.62½ s.	Dec. 30	Dec. 14
Electric Hose & Rubber Co.	Com.	0.30 q.	Feb. 20	Feb. 13
Firestone Tire & Rubber Co.	Com.	1.00	Jan. 20	Jan. 5
	4½% Pfd.	1.12¼ q.	Mar. 4	Feb. 15
General Cable Corp.	1st Pfd.	1.00 q.	Jan. 2	Dec. 28
	2nd Pfd.	0.50 q.	Jan. 2	Dec. 28
Goodall Rubber Co.	Com.	0.15 q.	Feb. 15	Feb. 1
Goodyear Tire & Rubber Co.	Com.	1.00 q.	Mar. 15	Feb. 15
	Pfd.	1.25 q.	Mar. 15	Feb. 15
Goodyear Tire & Rubber Co. of Canada, Ltd.	Pfd.	0.50 q.	Jan. 31	Jan. 1
Byron Jackson Co.	Com.	0.50 q.	Feb. 15	Jan. 31
Jenkins Bros., Ltd.	Com.	0.50 yr.-end	Jan. 2	Dec. 15
	Com.	0.25	Jan. 2	Dec. 15
Johnson & Johnson	2nd Pfd.	1.00 q.	Feb. 1	Feb. 1
	Com.	0.35 reduc.	Mar. 12	Feb. 23
	Com.	5% stock	Mar. 20	Feb. 23
Lea Fabrics, Inc.	Com.	0.37½	Feb. 28	Feb. 10
Lee Tire & Rubber Co.	Com.	0.75 incr.	Feb. 1	Jan. 18
National Automotive Fibres, Inc.	Com.	0.50 q.	Mar. 2	Feb. 15
Okonite Co.	Com.	0.25 q.	Feb. 1	Jan. 15
Thermoid Co.	$2.50 Conv. Pfd.	0.62½ q.	Feb. 1	Jan. 15
United Elastic Corp.	Com.	0.60	Mar. 9	Feb. 14
Westinghouse Air Brake Co.	Com.	0.50 q.	Mar. 15	Feb. 15



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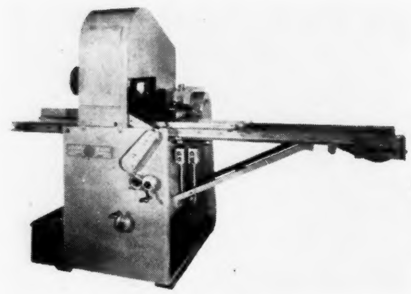
New Machines and Appliances



Black Rock Model SC-6 Cutter for Extruded Stock

New Extrusion Cutter

A NEW Black Rock cutter, Model SC-6, for cutting cured and uncured stocks directly from an extruder or tubing machine has been announced by Black Rock Mfg. Co., 175 Osborne St., Bridgeport 5, Conn. The new machine can be used to cut stock to desired size while the extruder is in operation. The cutter has a maximum stock capacity of six inches in diameter for rod or tube stock and will handle thin, flat stock up to 12 inches wide. In cutting stock of rectangular cross-section the capacity in width will be determined by the thickness.

The length of cut is variable up to a maximum of 28 inches by means of a positive variable transmission and adjustable throw eccentric. The length of cut can also be varied while the machine is in operation when it is desired to adjust for variations in stock volume. The cutting rate is variable from 20-160 cuts a minute through a two-hp. variable-speed main drive. This drive also allows for synchronizing the cutter speed with the tuber or extruber speed. The knife stroke is also adjustable in relation to the cutting block for handling various widths and thickness of flat stock. The 18½-inch diameter circular knife is independently driven by a five-hp., 1,200-rpm. motor.

The cutting machine is furnished complete with a six feet long, 12 inches wide input conveyer and driven stripper belt; three feet long, 12 inches wide take-off conveyer; anti-friction bearings throughout; and all gears and drive units completely enclosed and running in oil. Cutting lubricants other than water can be applied by use of a separate recirculating unit, which is available on order.

Now you can buy precision molding and high surface finish by the drum! And what's more, those drums of Dow Corning Silicone mold lubricants also reduce scrap to the vanishing point—cut your mold maintenance costs by as much as 80%. Clean molds stay cleaner longer and you get easier release of tires and parts with uniformly sharp detail and a high surface finish, free from blemishes, inside and out.

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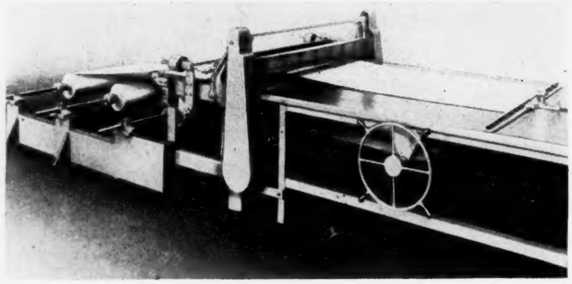


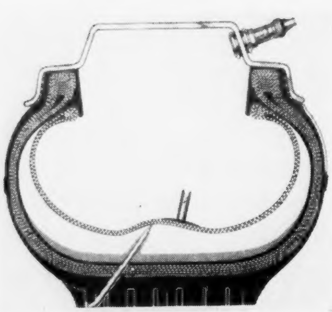
Jacques Power Shear with Manually Operated Feeding Table

Improved Power Shear

THE Jacques power shear, adjustable for either fully or semi-automatic production cutting of material from rolls or sheets, has been developed by Hobbs Mfg. Co., Worcester 5, Mass. The machine can be used for either intermittent or continuous cutting of up to 70 strokes per minute on such materials as plastics, laminates, textiles, papers, and light metals. Because the master feed roll and guides are an integral part of the central power cutting unit, many different types of feed arrangements can be used, including direct in-line flat sheeting feeds, single-roll feeds, and multiple-roll feeds.

Power is supplied direct from the motor to the cutting unit through a worm and gear transmission to the main drive shaft. Adjustable connecting arms from the drive shaft actuate the rigid, guillotine type, replaceable steel shear. Many types of conventional receiving gages are available on the power shear. For ordinary cuts receiving gages are made part of the cutting unit; while for long cuts or for special set-ups the gages can be on the receiving table. Standard feed and receiving tables are of kiln dried birch mounted on welded steel bases, but a wide variety of sizes and materials is also available. A smooth, even cut on all materials is provided by a binder safety clamp which can be adjusted to allow for variations in thickness of different materials. The standard sheer has a 50-inch cut blade, is 64 by 60 by 45 inches in size, and has a shipping weight of 1,125 pounds.

New Goods



Cross-Sectional View of New Firestone Tire Showing How Sealing Compound Flows around a Puncturing Nail and Prevents Air Loss

Puncture-Proof Tubeless Tire

A NEW tire said to be blowout-safe, puncture-proof, and tubeless has been developed by Firestone Tire & Rubber Co., Akron, O. Constructed of rayon and nylon cord, the new tire has an inner diaphragm which retains the great bulk of its air pressure and provides sufficient support to make the car controllable in case of a blowout. The tire is mounted on a special rim which has the air valve for inflating the tire. The diaphragm has a special one-way valve to permit inflation air to pass, but does not allow air to leak from the diaphragm if a puncture occurs in the tread portion.

The inside of the tire is coated with a Sealent compound from bead to bead. This sealing compound automatically stops the loss of air when a puncture occurs by clinging to the puncturing item as it enters the tire and filling the hole when the item is withdrawn. The new tire has been tested in service throughout the country and was given conclusive tests at the Indianapolis Speedway where a car driven at 80 miles an hour had a tire intentionally blown out, yet remained in perfect control and was brought to a normal stop. The tire can be used as a replacement on any modern automobile and is easy to balance, being entirely self-contained.

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EUROPE

GERMANY

Raw Rubber Hard to Get

The difficulties of obtaining adequate supplies of raw rubber together with the prevailing high prices have been matters for much concern among German rubber manufacturers, and the German Rubber Association has been calling meetings to discuss means of easing the situation. Apart from efforts to convince the authorities involved of the need of relaxing import restrictions on the one hand and of providing larger credits on the other, it is proposed to take steps to conserve rubber as much as possible, partly by voluntary elimination of goods that could be dispensed with and partly by efficient use of available supplies of raw rubber extended where possible by increased substitution of factice, reclaim, and synthetic rubber. The German Rubber Association suggests that technological commissions study how rubber can be most efficiently utilized in the different branches of the rubber industry and make their findings available to the individual firms who would be left free to apply them as they saw fit.

Tires in Short Supply

At last reports the shortage of tires continued unabated, a situation said to be caused by greatly increased demand in the face of an insufficient supply of rayon tire cord. Various reasons are given for the scarcity of rayon cord; some put it down to a lack of cellulose and coal; one source has it that some time ago, during a period of slackened demand, a certain number of rayon tire cord machines had been converted to the production of fine thread and cannot now be reconverted to spin tire cord again. As a result, it is stated, the German rayon industry, which was able to supply all needs for tires until the recent heavy demand set in, can now furnish only about 80% of requirements and is not expected to be able to increase supply appreciably for some time. Under the circumstances a return to the use of cotton cord has been reluctantly considered, and apparently some manufacturers have taken the step already. But any great relief from cotton is not held likely for not only is cotton more expensive and less satisfactory than rayon, but German cotton spinners, faced with United States restrictions on cotton exports and the difficulty of obtaining necessary foreign currency for imports, are reluctant to increase their output and reportedly will accept no new orders for the first quarter of 1951 and orders for only limited amounts in the second quarter of 1951.

Since the start of the Korean War prices of tires and tubes have risen considerably; in the latter part of 1950 three successive increases—in the beginning of August, beginning of September, and middle of November—have added 25 to 40% to prices, depending on sizes and types.

New Rubber Goods

Among the new goods recently put on the market by rubber manufacturers may be mentioned the Balatros Super belts of H. Rost & Co., Hamburg, provided in narrow widths for high speeds. They employ a special fine webbing for fabric plies that are only 0.5-millimeter thick and make for unusual flexibility, it is claimed.

Grooved tires for racing automobiles and motor cycles are now made by Metzeler A.G. Gummiwerk Fulda A.G., Fulda, has developed a Butyl inner tube. Porit Gummifabrik Conrad Zucht, K.G., Berlin-Spandau, which specializes in the manufacture of cellular rubber, now features a product resembling sponge rubber in which the cells are closed. Porozell, as the material is called, is said to have an unusually low specific gravity, to resist oil, benzine, and hydrocarbons and to be suitable for upholstery and as insulating material. It is available in different degrees of hardness.

German Dunlop at Hanau recently showed its first tire employing cord of Perlon artificial silk fibers. However, it seems that because of the costs involved, it will be some time before the new tires are made on a commercial scale.

Five Year Plan

In Eastern Germany a five-year plan has been set up to run from January 1, 1951, to the end of 1955, with the target an overall increase in production by various industries of 190% by the end of the period, as compared with the 1950 level. This would be double the level of 1936. Quotas for some of the more important industrial branches include: machinery, 121% above the 1950 level; textile, 101%; electrical industry, 96%; chemical industry, 82%. Synthetic rubber and automobile tires are grouped under chemical industries, and annual output of the former must reach 60,000 tons by 1955, an increase of 159% against 1950 output; while the target for motor vehicle tires is set at 900,000 units — an increase of 200%.

New methods of producing temperature resistant and other high-grade plastics, lacquers, and lubricants are to be developed and introduced into the industry in the five-year period. Up to 400,000,000 marks are to be set aside for research and development (not including geological investigations). Work on substitutes will include development and systematic application of plastics and artificial leathers, production of new and improved plastics, development of high- and medium-pressure synthesis, and by-products of coal.

The number of workers required is set at 7,600,000 for 1955, of which 2,800,000 are to be industrial workers; the percentage of women in factories and industry is to be raised, and productivity of workers is to be at least 60% above the 1950 level.

Converting Optimum Conditions of Cure

A method for accurately converting optimum conditions of cure, as found by heating in stages in the laboratory, to the factory for production use is explained by De. P. Kainradl, of the research and development division of Oesterreichisch-Amerikanishe Gummiwerke A. G. Traiskirchen.[1]

Put briefly, the course of the temperature in the laboratory and in test runs in the factory must be measured, and both vulcanization effects calculated and made to correspond.

The author has devised a table of "vulcanization numbers" which give the vulcanization effect for each rise of 1° C., from 120 to 150° C., inclusive. The numbers are based on the fact that an increase in temperature of 10° C. doubles the rate of the sulfur linking reaction. The measured temperature curves for cure under a given condition can be represented as "vulcanization numbers." The vulcanization effect at any temperature between 120 and 150° C., for a given period of time ($t_2 - t_1$) can be determined with a planimeter from the curves, and in addition, the point at which the vulcanization reaction begins can also be ascertained. By a suitable selection of the ordinate, t_2, in the factory process, the area under the curves for factory and laboratory cures can be mad to correspond.

The author claims to have used his method in the production of tires, large rolls, and with a continuous vulcanization process, among others, with very good results. In many cases the measurements showed that the temperature conditions during cure did not agree with the usual conceptions, and in almost all cases it was possible to effect improvements either from the standpoint of quality or economy.

[1]*Kautschuk u. Gummi*, 11, 395. (1950).

SEE PAGE 4

Plastics Conference

As in the preceding year, the various organizations of the plastics industry, including scientific, technological, and manufacturing associations, jointly arranged a convention, held in Munich, October 16-20, 1950. A large number of persons interested in the various aspects of the industry attended, including many from Switzerland, Austria, Holland, Sweden, and France. The following papers were presented:

"Relation between Mechanical and Electrical Properties of High Polymers," K. Wolf.

"Plastics—a Group between Steel and Fluids." F. H. Muller.

"Ko-Kneaders in the Manufacture of Plastics." H. List. (The so-called Ko-Kneter, continuous kneading and mixing machines, were apparently originally designed for the food and ceramics industry, but a special type has also been developed for plastics which mixes, kneads, and plasticizes at the same time. It is claimed that with this machine four out of six operators usually employed in producing phenoplasts can be dispensed with.)

"New Possibilities through Synthetic Adhesives." A. Hoechtlen. (Various new adhesives were discussed—the Redux adhesives of Aero Research, Ltd.; the Araldit brands put out by Ciba (Switzerland); and the iso-cyanate-based Desmocoll adhesives. The Ciba product is apparently especially suited for use on light metals.)

"Limitations and Modification of Modern Injection Molding Machines." M. E. Laeis. (The economics of installing large machines were chiefly discussed, and it was stressed that American practice cannot be transferred to Europe without due consideration of the difference in operation scales and consequent suitable modification. It was added that present production of injection molding machines by German firms could cover all home demands).

"Regulation and Control in Plastics Manufacture." W. Oppelt.

"Polyethylene in the Plastics Industry." A. Schwarz. (Polyethylene developments in the United States and the United Kingdom were reviewed. Since Germany too has begun to be interested in this material, and production here is increasing, the author thought it well to point to some relations beween molecular structure and properties which permit an insight into technological aspects and, at the same time, of the limits of application of the material.)

"New Processing Methods for Plastics." K. Stoeckhert.

"Effects of Change of Structure on Properties of Plastics." R. Gath.

"New Polyester-Based Plastics." E. Muller.

"The Technological Possibilities of the Silicones." S. Nitzsche.

"The Use of the Newer Plastics in the Electrical Industry." H. Heering.

Notes

The Dechema, German Society for Chemical Plant, reports that during 1950 it provided 134,775 German marks for the promotion of research and to give financial aid to needy students intending to become technical engineers. The Society further announces that the trustees of the Max Buchner Foundation for Research (administered by the Dechema), with a view to promoting research in chemical engineering, passed the following resolutions:

(1) The 1940 competition calling for papers on "The Devising of Methods of Dispersoid Analysis for Use in Industry," which was interrupted by the war, is now to be terminated, and 3,000 German marks have been provided as prize money. Of the papers sent in, three have been selected as practically of equal merit. It is planned to publish the papers during the first half of 1951.

(2) The best work in a year, starting with 1951, in the field of chemical and processing methods in chemical engineering will be awarded a prize of 5,000 German marks.

(3) The sum of 14,700 marks has been set aside for financing a series of researchers at German institutes.

(4) A series of investigations of general importance, proposed by industrialists, is to be examined with a view to their possible incorporation in the research programs of research institutes.

The Continental Gummi Werke A. G., reports that the rehabilitation of the branch in Frankfurt a.M. has been completed and the branch is working to capacity. The plant at Hannover-Stocken now produces 6,000 automobile tires daily; at the Korbach plant about 25,000 cycle tires and as many tubes are being made daily. Export, mainly to European countries, could be considerably increased. The total number of persons now employed by the concern has been increased to about 13,000, well below the 1939 total of about 16,000.

GREAT BRITAIN

Rubber on Exhibition

A nationwide Festival of Britain, commemorating the centenary of the first international industrial exhibition in London, will be held from May 1 to September 30. Principal attraction will be the special exhibition on a 30-acre area in the heart of London. Among the features will be displays revealing the history and the development of the rubber industry.

The British Industries Fair will run from April 30 to May 11 and will have exhibits by 100 industries and by more than 3,000 exhibitors. The rubber industry itself will be seen in various related sections.

The *Times* has put out a handsome illustrated survey of the Fair to which leaders and experts of the various industries have contributed articles comparing present conditions in their respective fields with those 100 years ago. Well covered is the British chemical industry. The article on petroleum equipment contains an illustration of the fractionating towers of the distillation unit and part of the butadiene hydrogenation and polymerization unit of the new Shell chemical plant at Stanlow, Chester.

IRI Elections

At the twenty-ninth annual general meeting in London, December 8, the Institution of the Rubber Industry elected the following officers for 1951: president, H. Rogers; vice presidents, F. D. Ascoli, Sir George Beharrell, S. A. Brazier, T. R. Dawson, H. A. Daynes, H. W. Franklin, H. B. Egmont Hake, A. Healey, T. H. Hewlett, E. C. Holroyd, A. Johnston, Fordyce Jones, H. T. Karsten, Sir Erid Macfadyen, G. Martin, H. Eric Miller, W. J. S. Naunton, S. S. Pickles, P. Schidrowitz, J. R. Scott, and D. F. L. Zorn; honorary treasurer, S. D. Sutton.

The following were elected to fill vacancies on the IRI council: T. A. Beazley, A. W. F. Chatfield, R. B. Clarke, M. M. Heywood, R. G. Newton, F. M. Panzetta, C. R. Pinnell, F. H. Puxty, A. Speedy, E. S. Tompkins, and M. A. Wilson.

On this occasion the President presented associateship and licentiateship diploma certificates to 34 of the members who had gained these awards during the year. Some of the leading technologists in the industry were included.

Trade Notes

On a site adjoining the Northern Polytechnic, London, work was begun January 15 on the new building for the National College of Rubber Technology. It is expected that the cost, including equipment, will be about $170,000.

A plant, to cost several million pounds will be built at Wilton, North Yorkshire, by Imperial Chemical Industries, Ltd., for the manufacture of the new textile fiber called Terylene. This British product is reportedly already being made in the United States under the name of "Fiber V."

In cooperation with the British Plastics Federation, the Plastics Institute, and the Plastics & Polymer Group of the Society of the Chemical Industry, "British Plastics" is organizing the British Plastics Exhibition and convention to be held in National Hall, Olympia, London, June 6-15. It is expected that the exhibition will be fully representative of all phases of the plastics industry and that British Commonwealth firms will participate. At the convention papers of interest to specialists will be offered. There are also to be special sessions open to the public during which the more general uses of plastics, in the home for instance, will be treated. A feature at the exhibition will be a display showing the true functions and possibilities of plastics.

SWEDEN

The newest foreign branch of the Rubber Foundation of Delft, Holland, was opened on October 15, in Stockholm, Sweden. The Scandinavian Rubber Bureau, as its name implies, will serve not only Sweden, but also Norway, Denmark, and Finland. Lt. Col. Curt Dahlgren, a well-known figure in Sweden's economic world, is to direct the Bureau.

Editor's Book Table

BOOK REVIEWS

"Rubber Trade Directory of Great Britain, 1950." Maclaren & Sons, Ltd., Stafford House, Norfolk St., Strand, London W.C.2, England. Cloth, 6 by 9½ inches, 752 pages. Price, $9 in United States and Canada.

This first edition of the new directory, compiled by the publishers of *India Rubber Journal,* presents a fully classified and comprehensive guide to all sections of the British rubber industry. An alphabetical list of manufacturers or suppliers and a classified list of products are given for each of the sections covering rubber manufacturers; rubber machinery and equipment; instruments and laboratory equipment; chemicals and compounding ingredients; fabrics and textiles; components; natural rubbers and latices; synthetic rubbers, latices, and kindred materials; reclaimed rubbers; scrap and waste rubber; and manufacturers' sundry requirements. Succeeding chapters cover trade marks and brand names used in the rubber industry; trade and research organizations; rubber technology schools and courses; and a who's who in the British rubber industry.

Both the table of contents and the subject index are given in English, French, German, and Spanish, and other appendices include a list of overseas agents and offices, a list of consultants, and an advertisers' index. The scope and the value of this volume are self-evident, and the publishers are to be commended for their authoritative work in filling the need of a directory of the British rubber industry.

"The Analytical Balance, Its Care and Use." William Marshall MacNevin. Handbook Publishers, Inc., Sandusky, O. Cloth, 5¼ by 7¾ inches, 73 pages. Price, $1.50.

This is a highly practical monograph on the care and the use of the modern analytical balance. Designed for use by technical workers with little or no training in the use of the balance, as well as for the average scientist, the book presents detailed information on the problems of selecting, mounting, cleaning, adjusting, testing, and repairing a balance. A section on the use of the balance is included for the beginner; while a section on testing the balance for performance characteristics is intended to aid the more advanced worker in obtaining improved performance. No attempt is made to discuss the theory of the balance, except for references to publish work on this subject, and discussions of individual makes of balances have also been omitted. Instead appear valuable lists of names and addresses of balance manufacturers and repair specialists. While instructions are given on determining when balance repairs are necessary and how to make simple repairs, the author emphasizes that major repairs should be made only by specialists. The practical approach and extreme usefulness of this volume will make it a valuable addition to the libraries of all research workers, students, and instructors.

"Industrial Solvents." Second Edition. Ibert Mellan. Rheinhold Publishing Corp., 330 W. 42nd St., New York 18, N. Y. Cloth, 6 by 9 inches, 768 pages. Price, $12.

This new edition represents the most comprehensive treatment of industrial solvents available. Much progress has been made in the manufacture and application of solvents since the original edition in 1939, and this new volume has been extensively rewritten and enlarged to cover these new developments. The original chapters on plasticizers, and graphic expression and interpretation have been deleted; while a new chapter has been added on safe handling of solvents. In addition, selected, bibliographies have been included in each chapter, and the data on solvents have been further correlated into a coherent system of discussion.

Theoretical aspects of solvents and solutions are covered in the first four chapters, as follows: nature of solution; solvents, latent solvents, non-solvents; vapor pressure, evaporation rate, boiling point; and viscosity. Following a general chapter on industrial application of solvents, and the new chapter on safe handling, come individual chapters where more than 380 solvents grouped according to types are discussed in detail, including physical data, commercial uses, and applications. Solvent types covered include hydrocarbon solvents, halogenated hydrocarbons, nitroparaffins, amines, alcohols, furfural, ketones, acids, ethers, and esters. The inclusion of a large number of graphs and tables provides a rapid means of obtaining specific and comparative data on the solvents discussed. A bibliography of references for further reading is appended to the book, together with comprehensive author and subject indices.

NEW PUBLICATIONS

"Maglite-D, a Magnesium Oxide Produced by a Patented Process for Use with Neoprene." R. D. Abbott. Marine Magnesium Products Corp., South San Francisco, Calif. 12 pages. Maglite D differs from the previously announced Maglite M in that it has a higher bulking factor, higher magnesium oxide content, shows less dusting, and is easier to incorporate into neoprene. Comparative test data appear for the two products in neoprene compounding.

"Decorative Treatments for Lustrex Styrene Plastic." Production Information Bulletin No. 62. Monsanto Chemical Co., Springfield, Mass. 28 pages. Decorative post-molding treatments for Lustrex are described in detail, including operating methods processes, materials used, and material suppliers. Treatments covered include metallizing, lacquering, all types of stamping and printing, destaticizing, and application of decalcomanias and labels.

"Rubber Grade Carbon Blacks at a Glance." United Carbon Co., Inc., Charleston 27, W. Va. 1 page. This chart gives the trade names and types of carbon blacks made by United Carbon, Huber, Cabot-General Atlas, Johnson, Columbian-Binney & Smith, Phillips, Witco-Continental, Thermatomic, and Richardson.

Bulletins of Harwick Standard Chemical Co., 60 S. Seiberling St., Akron 5, O. **"Piccocizer R."** 6 pages. **"Aromatic Plasticizer # 25."** 6 pages. Piccocizer R is suggested as a replacement or extender for light-colored high melting point coumarone-indene resins; while Aromatic Plasticizer #25 is a low melting point aromatic resin suggested as a replacement or extender for reinforcing-plasticizing resins. Properties of the two new materials are given, plus extensive test data comparing them with other resins in rubber compounds.

"Laminated Plastics Made with Bakelite Phenolic Varnishes." Bakelite Division, Union Carbide & Carbon Corp., New York 17, N. Y. 38 pages. This illustrated booklet presents information on the various grades and types of laminated plastics, their production, and their merchandising advantages. Test data on the properties of these laminates appear, together with information on methods used in fabrication and finishing.

"Wing-Stay S in Foamed Natural Rubber Latex." Techni-Guide #WS-2. Goodyear Tire & Rubber Co., Inc., Akron 16, O. 5 pages. The properties and uses of Wing-Stay S in foamed natural latex are discussed, and test data given on the properties obtained with this material in comparison with eight other antioxidants. Natural foam latex containing Wing-Stay S is shown to meet the requirements of the RMA buyer's guide specification on latex foam.

"Engineered Rubber Products for the Oil Refining Industry." United States Rubber Co., Rockefeller Center, New York 20, N. Y. 20 pages. This illustrated catalog covers engineering data on the company's mechanical goods division's products for refinery use. Products described include various types of hose, packing materials, expansion joints, and Uscolite thermoplastic pipe.

"Effect of Variable Philblack O and Softener Loadings in Cold Rubber, GR-S, and Natural Rubber." Philblack Bulletin No. 19, March, 1951. Phillips Chemical Co., Akron 8, O. 7 pages. Formulations and test data are given for basic compounds with variable Philblack O and softener loadings, similar to the data given in Bulletin No. 18 on variable Philblack A and softener loadings. The physical data obtained show a relation between compounds of the same series that permits the compounder to anticipate properties of different loadings.

"Farrel-Birmingham Rubber and Plastics Calenders." Bulletin 174. Farrel-Birmingham Co., Inc., Ansonia, Conn. 32 pages. This bulletin gives general specifications of the company's rubber and plastics calenders, recent design improvements, calender parts lists and drawings, diagrams of various roll arrangements, and more than 30 illustrations of calenders of different types and sizes. Also included are descriptions and illustrations of allied equipment, examples of engineered plant layouts, and illustrations of the company's process testing laboratory.

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SITUATIONS OPEN

WANTED—RUBBER CHEMIST FOR PROGRESSIVE FOOTWEAR plant. Must be experienced formulating compounds used in footwear and laboratory control. Give age, experience, education, previous employment, and salary expected. Our staff has been notified of this ad. Address Box No. 757, care of INDIA RUBBER WORLD.

WANTED—CHEMIST TO TAKE CHARGE OF LABORATORY IN well-established small plant in New England manufacturing rubber thread. Knowledge of compounding natural and synthetic, also adhesives. Permanent position. Please give details of experience and salary desired. Address Box No. 758, care of INDIA RUBBER WORLD.

SITUATIONS OPEN (Continued)

ENGINEER — PROCESS DEVELOPMENT

GRADUATE ENGINEER PREFERABLY WITH EXPERIENCE OR WORKING KNOWLEDGE OF RUBBER COMPOUNDING AND RUBBER EXTRUSION FOR WORK IN PROCESS DEVELOPMENT DEALING WITH THE PRODUCTION OF INSULATED WIRE AND CABLE. THE POSITION WILL INCLUDE THE DEVELOPMENT OF NEW PROCESSES AND THE IMPROVEMENT OF EXISTING PROCESSES INVOLVING ALL TYPES OF PRODUCTION PROBLEMS. WRITE STATING AGE, EDUCATION, EXPERIENCE, SALARY DESIRED, AND STATUS REGARDING THE ARMED FORCES. ADDRESS BOX NO. 756, c/o INDIA RUBBER WORLD

WANTED—CHEMICAL ENGINEERS AND CHEMISTS FOR production and pilot plant. Reply to KENTUCKY SYNTHETIC RUBBER CORP., P. O. Box 360, Louisville, Ky., stating education, experience, salary requirements.

A NATIONALLY RECOGNIZED RUBBER COMPANY HAS openings for TWO rubber chemists in its mechanical goods division located in the Southeast. Must have degree in chemistry from recognized engineering or technical school, with one to five years' experience in rubber technology. Address Box No. 759, care of INDIA RUBBER WORLD.

SPONGE RUBBER CHEMIST—OPENING FOR MAN WITH EXperience and ambition. Permanent position with excellent opportunity. Salary open. State all details first letter. Address Box No. 769, care of INDIA RUBBER WORLD.

PLANT ENGINEER: CANADIAN RUBBER MANUFACTURER IN province of Quebec requires engineer capable of organizing and supervising general plant maintenance and possessing a broad background of experience in the installation and maintenance of all types of rubber processing machinery. Ability to speak French is desirable. Give details of experience, education and salary requirements. Address Box No. 770, care of INDIA RUBBER WORLD.

LATEX SPECIALIST (MET. N. Y.). MUST BE CAPABLE OF supervising crew of 60 and to do new product developmental work in latex dipping plant. Salary open. Full particulars in first letter. All replies treated in strictest confidence. Address Box No. 771, care of INDIA RUBBER WORLD.

MARKET REVIEWS

CRUDE RUBBER

Commodity Exchange

WEEK-END CLOSING PRICES

Futures	Dec. 30	Jan. 27	Feb. 17	Feb. 24	Mar. 3	Mar. 10
Mar.	61.50	67.00	73.00	73.00	75.00	69.00
May	55.50	63.00	67.50	68.00	70.00	64.00
July	53.00	58.00	63.00	62.00	65.00	59.00
Total weekly sales, tons	1,660	410	10	50	400	210

TRADING in rubber futures on the Commodity Exchange during the period from February 16 to March 15 consisted of liquidation of open interest contracts, in accordance with the government directive to liquidate all open contracts by March 31. Some 40 contracts were liquidated during the second half of February, making a total for the month of 126 lots, or 1,260 tons. A total of 33 lots, or 330 tons, was liquidated during the first half of March, leaving 68 lots still to be liquidated.

Futures prices followed the movements of the spot and foreign markets. March futures started the period at 73.00¢, rose to 75.00¢ on February 19, dropped to 71.00¢ on February 21, and closed the month at 73.00¢. After closing at 75.00¢ on March 1 and 2, March futures declined steadily to a low of 68.00¢ on March 14 and then recovered somewhat to end the period at 69.50¢. May and July futures, the only other months carried on the board, showed similar price fluctuations.

New York Outside Market

WEEK-END CLOSING PRICES

	Dec. 30	Jan. 27	Feb. 17	Feb. 24	Mar. 3	Mar. 10
No. 1 R.S.S.	79.00	72.00	74.00	75.00	75.00	70.00
No. 3 R.S.S.	76.50	70.00	72.00	73.50	73.50	68.50
No. 2 Brown	72.00	61.00	63.00	63.00	63.00	59.00
Flat Bark	66.00	51.00	55.00	48.00	48.00	44.00

TRADING in physical rubber on the New York Outside Market during the latter half of February was light in volume and consisted of scattered trade covering of open commitments made before the imposition of government import controls. Prices were firm at levels that did not permit any government stockpile purchasing. This policy resulted in a gradual accumulation of rubber at unloading docks, with approximately 20,000 tons estimated to be piled up early in March.

This surplus stock of rubber resulted in a price decline that enabled the government to enter the market and actively purchase rubber. The easier prices also reflected a build-up of Far Eastern surplus rubber during the past few months, but with renewed government buying this surplus is expected to dry up quickly, and firmer prices are expected to prevail. This view was apparently shared by the government, which revised its price ideas upward toward the middle of March and continued to buy rubber in volume.

No. 1 sheets began at 74.00¢ on February 16, reached 75.00¢ on February 20 and 23, and closed the month at 74.00¢. After starting at 75.00¢ on March 1 and 2, No. 1 sheets dropped steadily to a low of 68.00¢ on March 12 and 13, then rose to 70.00¢ on March 15. Similar price fluctuations were shown by the other rubber grades. No. 3 sheets went from 72.00¢ to 68.50¢ during the period, with a low of 66.50¢ on March 12 and 13. No. 2 Brown held at 63.00¢ during the second half of February and the beginning of March, fell to a low of 57.00¢ on March 12 and 13, and then recovered to close at 59.00¢ on March 15. Flat Bark started the period at 55.00¢, declined to a low of 42.00¢ on March 12 and 13, and closed the period at 44.00¢.

Latices

SECOND-QUARTER permissible usage of *Hevea* latex under NPA Order M-2 is expected to be between 12,000 and 15,000 tons, including DO usage, according to Arthur Nolan, Latex & Rubber, Inc., writing in the March issue of *Natural Rubber News*. DO requirements for *Hevea* latex have not become heavy as yet and are currently estimated at about 500 tons a month. The major factor in keeping consumption down is probably the 84.5¢ a pound price of latex. At this level many latex products are no longer being manufactured; while others have been cut back.

It is expected that some latex production in Malaya will be turned back to sheet production, Mr. Nolan states. The effect of such conversions will take months to be felt and will not be of sufficient magnitude to reduce seriously world production of *Hevea* latex. The amendment to M-2, issued March 1, curtailed natural latex usage in toys and certain novelty products. Its effect on most latex products is moderate and practical, and no major hardship or difficulties are currently expected from its regulations, Mr. Nolan reports.

GSA terms of payment for sales of its latex are currently "cash upon presentation of invoice." Stockpile endeavors are said to be continuing smoothly, with no adverse effect on *Hevea* latex supplies needed for regular consumption by industry. Numerous adjustments in NPA lease-period allocations are being made for compounded latex on the basis that latex is considered to be "consumed," when first compounded, for the purposes of M-2.

January statistics on *Hevea* latex are not available as yet, but February production of GR-S latex is given as 2,739 long tons, dry weight, a decrease of 537 long tons from the January figure.

RECLAIMED RUBBER

NO CHANGE occurred in the reclaimed rubber market during the period from February 16 to March 15. Production and consumption of reclaim remained at top levels, and there was a continuing shortage of inner tube reclaims because of the unavailability of tube scrap supplies.

The only newsworthy event taking place during the period was the meeting on March 19 of OPS officials with representatives of the reclaiming industry to discuss the advisability of establishing specific dollar and cents ceiling prices for reclaim at the manufacturing level. While this meeting was of a general and exploratory nature only, industry representatives were reported to believe that the general ceiling price regulation should be revised because of the current wide variance of prices throughout the reclaim industry.

OPS representatives at the meeting included Hubert H. Peterson, chief of the tire and raw materials section, who acted as chairman; Chester F. Connor, chief of the rubber branch; and George W. Strasser, acting director of the rubber, chemicals, and drugs division. Members of the reclaimed rubber industry committee, appointed by OPS on March 19, are: Jean H. Nesbit, U. S. Rubber Reclaiming Co.; William Welsh, Midwest Rubber Reclaiming Co.; Carl R. Shaffer, Xylos Rubber Co.; J. E. Thomas, Philadelphia Rubber Works Co.; B. M. Rosenthal, Nearpara Rubber Co.; P. M. Reed, Pequanoc Rubber Co.; Robert E. Casey, Naugatuck Chemical Division, United States Rubber Co.; and Irving Laurie, Laurie Rubber Reclaiming Co.

Reclaimed Rubber Prices

	Sp. Gr.	¢ per Lb.
Whole tire	1.18-1.20	10.00/10.75
Peel	1.18-1.20	nom.
Inner tube		
Black	1.20-1.22	nom.
Red	1.20-1.22	nom.
GR-S	1.18-1.20	nom.
Butyl	1.16-1.18	nom.

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims in each general group separately featuring characteristic properties of quality, workability, and gravity at special prices.

SCRAP RUBBER

A STRONG demand and higher prices were noted in the scrap rubber market during the period from February 16 to March 15. Price rises were recorded in almost all grades of scrap, with actual trading being limited by a lack of scrap supplies. Scrap stocks were used to fill orders, but dealers reported difficulty in replenishing depleted stocks, and collections are reported to be becoming more intensive.

Demand was high for both tire and tube scrap, and reclaimers were said to be competing with each other for available supplies of both red and black tubes. Although scrap dealers expect that ceiling prices will soon be imposed on scrap rubber, the new higher prices given in the table below are said to be within the permissible ceilings since tire scrap had previously gone to higher price levels in Akron.

Following are dealers' selling prices for scrap rubber, in carload lots, delivered to mills at the points indicated:

CLASSIFIED ADVERTISEMENTS

Continued

MACHINERY AND SUPPLIES FOR SALE

FOR SALE: 1—6' x 18' HIGH-PRESSURE VULCANIZER, QUICK-opening door. RUBBER MILLS, 6" x 12", 10" x 24", 16" x 30", each with motor and drive; 1—32" x 45" Hydraulic Press, 24-inch ram. Also Tubers, Vulcanizers, Hydraulic Presses, Calenders, etc. CONSOLIDATED PRODUCTS CO., INC., 13-16 Park Row, New York 7, N. Y. Phone: BArclay 7-0600.

FOR SALE: FARREL 18" x 45", 16" x 48", AND 15" x 36", 2-ROLL Rubber Mills, also new Lab. 6" x 12" Mixing Mills and Calenders, & other sizes up to 84". Rubber Calenders. Extruders 2" to 3". Ball & Jewell Rotary Cutters. Sargent 3-apron conveyer, 6-fan Rubber Drier. Baker-Perkins Mixers 200 & 9 gals. heavy-duty double-arm jacketed; also single-arm mixers. Impregnating Units Lab. size & up. Large stock Hydraulic Presses from 12" x 12" to 42" x 48" platens, from 50 to 1500 tons. Hydraulic Pumps and Accumulators. Grinders, Cutters, Crushers, Churns, etc. SEND FOR SPECIAL BULLETIN. WE BUY YOUR SURPLUS MACHINERY. STEIN EQUIPMENT COMPANY, 90 WEST STREET, NEW YORK 6, N. Y.

FOR SALE: 24 x 48 FARREL CALENDER EXTRA-HEAVY DUTY 3-roll — new 1948 — used very little. With Farrel Herringbone Reduction Gear unit, automatic oiler, Herringbone connecting and bull gear. Even and friction speeds, bed plate. No motor or controls. Push-button adjustments. Address Box No. 765, care of INDIA RUBBER WORLD.

REBUILT BANBURY BODIES, NO. 11, NO. 9, NO. 3A, AND No. 3, spray or jacketed types, for sale or interchange. These bodies are complete with door and cylinder and are in A-1 shape. Write or wire INTERSTATE WELDING SERVICE, Office, Metropolitan Building, Akron 8, Ohio.

FOR SALE: BANBURY MIXERS, MILLS, CALENDERS, LABORATORY Mill and Banbury Unit, Extruders, Tubers, Hydraulic Presses. Send for detailed bulletin. EAGLE INDUSTRIES, Inc., 110 Washington Street, New York 6, N. Y. DIgby 4-8364-5-6.

FOR SALE: 3-ROBINSON UNIQUE FRIGIDISC GRINDERS WITH 50 hp. 220/440-volt integral motors made by Mercer Robinson Co., New York City—2 new—1 only slightly used. 1-Robinson gyro sifter—slightly used. 2—Thropp 8-opening presses, 36 x 36 steam heated platens—18" rams for 2,000 lb. W. P. 1—Thropp 4-opening press, 36 x 36 steam heated platens, new 18" chrome plated ram for 2,000 lb. W. P. 1—#3A Coulter special volumetric blanking machine for heel and sole biscuits—new. 1—Biggs Boiler Works open steam vertical vulcanizer 36" diam. x 48" deep with hinged counterbalanced cover—new. 1—Pancorbo chopper-less motor, used. 1—Pancorbo span grinder, used. 2 Lawson 38" square paper or stock cutters, used. 1—Chandler Price 39" square paper or stock cutter, used—with motor. Address Box No. 766, care of INDIA RUBBER WORLD.

FOR SALE, DOUBLE-ARM JACKETED MIXERS, SIGMA BLADE —25 gal. to 250 gal.—J. H. Day, W & P, Read, etc. Stokes Rotary 16-punch pellet presses. PERRY EQUIPMENT CORP., 1524 W. Thompson St., Phila. 21, Pa.

BANBURY PARTS: ROTORS, END FRAMES, ROTOR COLLARS, side jackets, door tops, cylinders, rings, and other parts for Banbury's No. 3, No. 3A, No. 9 and No. 11. Every part in A-1 condition. For emergency repairs, or for complete Banbury rebuilding, write or wire INTERSTATE WELDING SERVICE, Office, Metropolitan Building, Akron 8, Ohio.

FOR SALE: A COMPLETE PRESS ROOM CONSISTING OF 30 presses with platens ranging from 24" x 24" to 42" x 42" with a complete variety of daylight openings and ram sizes. 2 high-pressure Worthington pumps with accumulators for both. 1—#½ Royle extruder complete with motor and controls. 1—#2 Royle extruder with 4 speed A. C. motor and controls. 1—60 h.p. Fuller water-cooled compressor with controls. 1—12" x 24" Ferriot guillotine cutter with a 24" stroke. 1—Struthers Wells 150 w.p. 4" x 17" pot vulcanizer with automatic shuttight door, tracks and cars. Washers, Tumblers, Tables, etc. All the above equipment is in excellent condition and can be seen in operation. For further details write Box No. 775, care of INDIA RUBBER WORLD.

	Eastern Points	Akron, O.
	(Per Net Ton)	
Mixed auto tires	$33.00	$33.00
Peelings, No. 1	65.00	65.00
3	35.00	35.00
	(¢ per Lb.)	
Black Inner tubes	11.50	11.50
Red passenger tubes	16.00	16.00

COTTON AND FABRICS

New York Cotton Exchange
Week-End Closing Prices

Futures	Nov. 25	Dec. 30	Jan. 27	Mar. 10
May	42.14	42.51	43.77	45.39
July	41.40	41.86	43.31	44.91
Oct.	36.35	39.18	41.36	41 50
Dec.	35.80	38.72	40.96	40.80
Mar.	35.70	38.46	40.86	40.65
May	35.45	38.25	40.67	40.52
July	....	....	40.40	40.07

ON MARCH 3 raw cotton joined the ranks of products under specific price control when the OPS issued Ceiling Price Regulation 8, effective immediately, setting up maximum prices by grade, staple, and location for domestic raw cotton at all sales levels, including the farmer. The basic ceiling price is 45.76¢ a pound on white and extra-white middling 15/16-inch cotton in area one, comprising a group of counties in the Carolinas, and the regulation provides prices for other grades, staples, and locations. In issuing the regulation Price Stabilizer M. DiSalle pointed out that the new ceilings are well above the current parity price of 33.11¢ a pound and will thus encourage increased production.

Under the General Ceiling Price Regulation of January 26 raw cotton had been exempted at the producer level, but controlled when sold by merchants and other cotton dealers. In a separate statement on March 3, the United States Department of Agriculture said that it had suggested alternate methods of control, but would go along with the new OPS order.

Issuance of CPR 8 aroused an outcry in Congress by southern legislators, and the joint Congressional watchdog committee on economic mobilization began to hold sessions to consider the problem. The whole cotton price control issue appeared headed back into the political arena, but as of March 15 no Congressional action was taken on the matter. This was not surprising inasmuch as the ceilings were set at levels high enough to meet the most optimistic demands of cotton producers.

The ceiling price regulation did nothing to clarify the problems of the cotton exchanges. Exchange regulations provide for delivery of cotton against a futures contract at any one of eight points; whereas CPR 8 gave a different price basis for each delivery point. In response to requests by industry representatives for a specific ceiling on the futures contract which would be the basis for delivery, the OPS on March 6 issued Supplementary Regulation 1. This order set a ceiling price of 45-39¢ a pound for all futures contracts on white and extra-white middling 15/16-inch cotton. This price represents a price of 44.84¢ a pound for the cotton, plus an allowance of 0.55¢ a pound to cover costs involved in delivering cotton against a futures contract. In addition, price differentials for other grades of cotton set forth in CPR 8 will apply to the futures market. The supplementary order also permits fulfillment of contracts for the sale of raw cotton entered into by producers prior to CPR 8.

After being closed since January 27, the New York Cotton Exchange reopened on March 8. Despite a tremendous volume of orders, trading was orderly. Spot cotton closed at the ceiling price of 46.06¢ a pound and remained at that level until the end of the market period (March 15). March and May futures also held at the ceiling price of 45.39¢, but the more distant months showed small declines toward the middle of March as forecasts were made of an abundant new crop of cotton this fall.

Cotton and Fabrics

After a period of watchful waiting during the time the cotton exchanges were closed, the gray goods market showed a more active trading tempo after the resumption of futures trading on March 8. Total activity was still only moderate, since many mills were completely sold out through the second quarter and reluctant to enter into any third-quarter sales pending the expected issuance of specific ceilings on industrial cotton fabrics.

Demand continued strong for all fabric constructions, with all types of gray goods in short supply, particularly for nearby or spot delivery. Especially critical shortages were noted in osnaburgs and army and numbered ducks. The osnaburgs were reported to be difficult to obtain even in limited yardages for the third quarter. The army and numbered duck shortage followed the pattern observed early in World War II, and supplies are said to be definitely inadequate to meet both military and essential civilian needs. Carpet mills are already being called on to supply ducks at higher prices, but the problem of the industry lies in the shortage of twisted yarns needed for weaving the ducks. Many former producers of these yarns have switched to synthetics, and the cotton tire cord manufacturers, who produced yarn for ducks during the war, are sending their entire output to the tire industry. The only remedy appears to be a government order directing yarn producers and tire cord manufacturers to convert a high percentage of their output to carded twisted yarns for use in army and numbered ducks.

Cotton Fabrics

Drills			
59-inch 1.85-yd	yd.	$0.49 /	$0.50⅛
2.25-yd		.42 /	.42⅞
Ducks			
38-inch 1.78-yd. S. F.	yd.	.48⅞ /	.50⅝
2.00-yd. D. F.	yd.	.445 /	.46
51.5-inch, 1.35-yd. S. F.		.645 /	.66⅝
Hose and belting		.82	
Osnaburgs			
40-inch 2.11 yd	yd.	.385	
3.65-yd	yd.	.235	
Raincoat Fabrics			
Bombazine, 64x60 5.35-yd	yd.	nom.	
Print cloth, 38½-inch, 64x60		.23 /	.2375
Sheeting, 48-inch, 4.17-yd.		.26⅞ /	.27⅜
52-inch 3.85-yd		.29⅛ /	.29⅜
Chafer Fabrics			
14-oz sq. yd. Pl	lb.	.84 /	.865
11.65-oz. sq. yd. S		.78	
10.80-oz. sq. yd. S		.8175 /	.82
8.9-oz. sq. yd. S		.83 /	.845
Other Fabrics			
Headlining, 58-inch 1.35-yd., 2-ply	yd.	.62	
64-inch, 1.25-yd. 2-ply		.725 /	.74
Sateens, 53-inch 1.32-yd		.71 /	.725
58-inch 1.21-yd		.775 /	.79⅛

Tire Cords

K. P. std., 12-3-3	lb.	nom.
12-4-2		$0.95

RAYON

TOTAL domestic shipments of rayon by United States producers during February amounted to 99,600,000 pounds, a decline of 5% from the January level, resulting from the lower number of working days. Rayon shipments during the first two months of this year totaled 204,300,000 pounds, an increase of 4% over the corresponding 1950 figure. During this year's period, shipments of viscose high-tenacity yarn were 50,500,000 pounds, or 3% above total shipments in January-February, 1950.

Plans for the construction of new plants to produce high-tenacity viscose rayon for tires and related uses were announced by two companies during the month. North American Rayon Corp. will construct a new plant having a capacity of 27,000,000 pounds of yarn per year at Coosa Pines, Ala. The new plant is expected to start operations in about a year. Eastern Rayon Mills, Inc., will build a new plant in West Virginia to produce approximately 12,000,000 pounds annually of viscose high-tenacity yarn and tow. This plant is scheduled to begin production in June, 1952, using continuous spinning processes throughout.

There were no changes in rayon tire yarn and fabric prices during the period from February 16 to March 15, and current prices follow:

Rayon Prices

Tire Yarns	
1100/ 480	$0.62/$0.63
1100/ 490	.62
1150/ 490	.62
1650/ 720	.61/ .62
1650/ 980	.61
1900/ 980	.61
2200/ 960	.61
2200/ 980	.60
4400/2934	.63
Tire Fabrics	
1100/490/2	.72
1650/980/2	.695/.73
2200/980/2	.685

Trade Lists Available

The Commercial Intelligence Branch, United States Department of Commerce, Washington, D. C., recently compiled the following trade lists, of which mimeographed copies may be obtained by American firms from this Branch and from Department of Commerce field offices at $1 a list for each country.

Automotive Equipment Importers & Dealers—Angola; Argentina; Barbados; British Honduras; British Malaya; Egypt; El Salvador; Hong Kong; Indonesia; Japan; Netherlands West Indies; Paraguay; Peru; Spain.

Automotive Product Manufacturers—Australia; Austria; Ceylon; Chile; Egypt; Lebanon; Netherlands; Norway; Philippines; Portugal; Thailand; Turkey; Venezuela.

Plastic Materials Manufacturers & Molders, Laminators & Fabricators of Plastic Products—Austria; Chile; Egypt; Israel; New Zealand; Philippines; Portugal; Switzerland; Venezuela.

Rubber Exporters—Ceylon.

Rubber Goods Manufacturers—Cuba; Italy; New Zealand; Turkey.

Rubber Growers, Producers & Exporters—Thailand.

Sporting Goods, Toy & Game Importers & Dealers—Australia; Belgium; Chile; Denmark; Indonesia; Mexico; Netherlands West Indies; Peru; Switzerland; Uruguay.

Toy & Game Manufacturers—Denmark.

CLASSIFIED ADVERTISEMENTS

Continued

MACHINERY AND SUPPLIES FOR SALE (Continued)

FOR SALE: 2—15- X 36-INCH MILLS, COMPLETE WITH 75 H.P. motor and drive. Available for immediate installation. Address Box No. 774, care of INDIA RUBBER WORLD.

BUSINESS OPPORTUNITIES

WANTED TO BUY

PLANT NOW IN OPERATION OR FULLY EQUIPPED WITH LEAD PRESS SUITABLE FOR HEATER HOSE, GARDEN HOSE, ETC. GIVE FULL PARTICULARS IN FIRST LETTER. REPLIES CONFIDENTIAL. PRINCIPALS ONLY.

ADDRESS BOX NO. 755, c/o INDIA RUBBER WORLD

RUBBER AND GR-S MIXING, COMPOUNDING, AND CALENDERing. All work done under careful supervision. Contract work invited. Phone New Haven 8-6151. ELM CITY RUBBER CO., Box 1864, New Haven, Conn.

WE ARE INTERESTED IN PURCHASING OR LEASING A small or medium sized rubber plant. Advise what you have to offer. Address Box No. 763, care of INDIA RUBBER WORLD.

BANBURY CAPACITY NEEDED IN NEW YORK OR NEW JERsey to compound black masterbatches for our account in carload lots. Address Box No. 764, care of INDIA RUBBER WORLD.

RUBBER PLANT FOR SALE OR RENT. COMPLETELY EQUIPped—in active production—excellent opportunity. Address Box No. 768, care of INDIA RUBBER WORLD.

OPEN TIME FOR GRINDING AND PULVERIZING OF MANY friable plastic resins and scrap to your specifications. Phone New Haven 8-6151. ELM CITY RUBBER CO., Box 1864, New Haven, Conn.

MIXING AND MASTICATION CAPACITY AVAILABLE to customers' specifications on No. 3A Banbury Type Machine. We are manufacturers of Molded, Lathe Cut, and Extruded Soft Rubber Goods and have surplus mixing capacity.

MARTIN RUBBER COMPANY

Long Branch Ave., Long Branch, N. J.
Telephones: Long Branch 6-1221-1222

MACHINERY AND SUPPLIES WANTED

WANTED TO BUY: ONE MULTI-OPENING HYDRAULIC PRESS, minimum size platens 44" x 64", 6 to 8 openings, 4" daylight between platens. Single ram minimum diameter 20". Preferably with self-contained hydraulic pumping unit. ACADIA SYNTHETIC PRODUCTS DIVISION, WESTERN FELT WORKS, 4115 Ogden Avenue, Chicago 23, Ill. CRawford 7-8000.

WANTED: 60-INCH HEAVY-DUTY MILL. ALSO 3-ROLL CALENDER with 40-inch to 66-inch rolls. Address Box No. 773, care of INDIA RUBBER WORLD.

WANTED: RUBBER ROLL—18 BY 36—MUST BE IN PERFECT operating condition. State particulars and price. PLASTIC PRODUCTS, INC., 415 Lexington Avenue, New York 17, N. Y.

MISCELLANEOUS

WE HAVE THE FOLLOWING STOCKS OF COLORS IN OUR inventory in excess of our need: 1,225 lbs. Du Pont Rubber Red P.B.D. M/B. 566 lbs. Du Pont Rubber Orange F. D. M/B. 195 lbs. Du Pont Rubber Yellow G. D. M/B. 72 lbs. Du Pont Red 2 B. D. M/B. 373 lbs. Cooks Orange M/B. 1,600 lbs. Cooks Red #417 M/B. 106 lbs. Cooks Green #411 M/B. 345 lbs. B'klyn Green #318 (Powder). 71 lbs. B'klyn Green #318 (Powder). 91 lbs. B'klyn Red #3789 (Powder). 92 lbs. B'klyn Rubber Red #18 (Powder). 821 lbs. B'klyn Red #3171 (Powder). 1,048 lbs. B'klyn Red #3179 (Powder). All the above are in the original containers and are fresh stock. For further information and prices, please write Box No. 776, care of INDIA RUBBER WORLD.

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WANTED

Financially responsible organization will purchase complete sponge and mechanical rubber goods plant with presses, calenders, mills and extruders. Will consider all offers. Please give complete details first letter.

Address Box 555,
c/o INDIA RUBBER WORLD

CUSTOM MIXING

We do milling and compounding of all types — blacks or colors — Master Batches —
All mixing done under careful supervision and laboratory control.

PEQUANOC RUBBER CO.

Phone: Butler 9-0400 BUTLER, NEW JERSEY

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Glycols — Cellosolves — Ethanolamines — Titaniums
Zinc Oxide—Dyes—Colors—Chlorinated Solvents
Zinc, Nickel, Cadmium Metals and Chemicals

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80 Beaver St., New York 5 HAnover 2-6970

WANTED — Large engineering firm wishes to acquire several complete Rubber Plants through purchase of (1) capital stock, (2) assets, (3) machinery and equipment, whole or in part. Personnel retained where possible, strictest confidence. Box 1220, 1474 Broadway, New York 18, N. Y.

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STOCK SHELLS HOSE POLES
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NATIONAL SHERARDIZING & MACHINE CO.

868 WINDSOR ST. HARTFORD, CONN.
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INDIA RUBBER WORLD

386 FOURTH AVE. NEW YORK 16, N. Y.

U. S. Imports, Exports, and Reexports of Crude and Manufactured Rubber

Exports of Domestic Merchandise

	December, 1950 Quantity	December, 1950 Value
UNMANUFACTURED, Lbs.		
Chicle and chewing gum bases	219,872	$86,419
Balata	3,515	4,352
Jelutong and gutta percha	15,653	5,938
Synthetic rubbers: GR-S	123,654	26,049
Neoprene	1,188,748	452,306
Nitrile	360,326	170,797
"Thiokol"	300	210
Other, except Butyl and polyisobutylene	4,301	13,306
Reclaimed rubber	2,781,045	268,462
Scrap rubber	4,450,210	223,957
TOTALS	9,147,624	$1,251,796
MANUFACTURED		
Rubber cement ... gals.	105,182	$243,013
Rubberized fabric		
Auto cloth ... sq. yds.	12,515	7,963
Piece goods and hospital sheeting ... sq. yds.	111,690	80,624
Rubber footwear		
Boots ... prs.	12,592	68,776
Shoes ... prs.	2,801	5,255
Rubber-soled canvas shoes ... prs.	9,361	15,043
Soles ... doz. prs.	21,751	67,691
Heels ... doz. prs.	79,852	67,891
Soling and toplift sheets ... lbs.	647,806	119,350
Gloves and mittens ... doz. prs.	11,200	44,100
Drug sundries: water bottles and fountain syringes ... no.	20,077	14,414
Other	......	327,624
Rubber and rubberized clothing	......	55,102
Toy and novelty balloons	......	31,064
Toys and balls	......	26,181
Erasers ... lbs.	33,382	21,863
Hard rubber goods		
Battery boxes ... no.	32,830	61,726
Other electrical goods ... lbs.	146,877	61,343
Combs, finished ... doz.	1,447	2,775
Other	......	12,040
Tires and casings		
Truck and bus ... no.	52,018	2,513,449
Auto ... no.	63,505	959,877
Aircraft	......	83,762
Farm tractor, etc. ... no.	6,002	271,159
Other off-the-road types ... no.	8,657	906,908
Bicycle ... no.	27,407	42,100
Motorcycle ... no.	540	5,277
Other ... no.	1,805	37,048
Inner tubes: auto ... no.	30,843	71,238
Truck and bus ... no.	46,085	190,986
Aircraft ... no.	362	3,893
Other ... no.	15,992	42,079
Solid tires: truck and industrial ... no.	1,450	31,743
Tire repair materials		
Camelback ... lbs.	275,974	95,443
Other ... lbs.	354,292	270,373
Rubber and friction tape ... lbs.	79,314	53,189
Belting: auto and home ... lbs.	90,904	120,368
Transmission		
V-belts ... lbs.	119,487	218,284
Flat belts ... lbs.	47,909	65,728
Other ... lbs.	18,874	29,321
Conveyer and levitator ... lbs.	117,093	131,254
Other ... lbs.	647	1,516
Hose and tubing ... lbs.	496,083	409,231
Packing ... lbs.	193,534	205,443
Mats, flooring, tiling ... lbs.	646,516	167,510
Thread: bare ... lbs.	26,604	45,808
Textile covered ... lbs.	20,394	53,245
Gutta percha manufactures ... lbs.	727	972
Latex and other rubber compounds for further manufacture ... lbs.	691,990	249,230
Other natural and synthetic rubber manufactures	......	579,058
TOTALS	......	$9,188,970
GRAND TOTALS, ALL RUBBER EXPORTS	......	$10,440,766

Reexports of Foreign Merchandise

	December, 1950 Quantity	December, 1950 Value
UNMANUFACTURED, Lbs.		
Crude rubber	3,135,472	$1,757,047
Balata	5,115	2,148
Scrap rubber	22,400	4,073
TOTALS	3,162,987	$1,763,268
MANUFACTURED		
Rubber footwear		
Boots ... prs.	230	$955
Drug sundries, except water bottles and fountain syringes	......	407
Rubber toys and balls	......	1,547
Tires and casings		
Motorcycles ... no.	24	230
Other natural and synthetic rubber manufactures	......	694
TOTALS	......	$3,833
GRAND TOTALS, ALL RUBBER REEXPORTS	......	$1,767,101

Imports for Consumption of Crude and Manufactured Rubber

	December, 1950 Quantity	December, 1950 Value
UNMANUFACTURED, Lbs.		
Crude rubber	146,232,052	$66,092,508
Latex	8,856,275	5,191,321
Crude chicle	1,988,478	1,378,741
Guayule	56,000	24,864
Balata	277,704	126,709
Jelutong or Pontianak	184,629	91,411
Gutta percha	62,265	16,361
Synthetic rubber	3,591,344	778,078
Reclaimed rubber	341,486	31,496
Scrap rubber	8,133,314	277,573
TOTALS	169,723,547	$74,009,062
MANUFACTURED		
Tires and casings		
Auto, etc. ... no.	1,862	$92,206
Bicycle ... no.	4,258	4,001
Inner tubes: auto, etc., no.	5,496	6,374
Rubber footwear		
Boots ... prs.	10,056	28,630
Shoes and overshoes, prs.	18,900	7,384
Rubber-soled canvas shoes ... prs.	12,985	4,401
Athletic balls: golf ... no.	47,524	12,097
Tennis ... no.	19,776	4,557
Other ... no.	82,680	7,886
Rubber toys, except balloons	......	25,706
Hard rubber goods	......	58,927
Rubberized printing blankets ... lbs.	508	918
Rubber and cotton packing ... lbs.	4,207	$5,353
Gaskets and valve packing	......	36
Molded insulators	......	9,192
Belting ... lbs.	14,667	15,152
Hose and tubing	......	2,706
Drug sundries	......	11,827
Instruments ... doz.	1,300	6,630
Other rubber products	......	458
Gutta percha manufactures ... lbs.	800	589
Rubber bands ... lbs.	4,951	2,726
Synthetic rubber goods	......	818
Other soft rubber goods	......	98,316
TOTALS	......	$406,890
GRAND TOTALS, ALL RUBBER IMPORTS	......	$74,415,952

SOURCE: Bureau of Census, United States Department of Commerce, Washington, D. C.

Compounding Ingredients — Price Changes and Additions

Accelerator-Activators, Organic

Emersol 110	lb.	$0.2375	/ $0.25
120	lb.	.2425	/ .255
130	lb.	.265	/ .2775
210 Elaine	lb.	.2425	/ .27
Hyfac 430	lb.	.2475	/ .26
431	lb.	.2575	/ .27

Bonding Agents

Ty-Ply BN	gal.	6.75	/ 8.00

Latex Compounding Ingredients

Marmix	lb.	.41	/ .48

Reinforcers, Other Than Carbon Black

Marbon resins	lb.	.41	/ .48

Estimated Automotive Pneumatic Casings and Tube Shipments, Production, Inventory, January, 1951; December, January, 1950

	January, 1951	% of Change from Preceding Month	December, 1950	January, 1950
Passenger Casings				
Shipments				
Original equipment	2,592,541		2,801,120	2,747,771
Replacement	3,061,918		3,394,646	2,190,651
Export	52,554		67,292	48,880
TOTAL	5,707,013	—8.88	6,263,058	4,987,302
Production	5,433,309	—3.60	5,635,980	5,710,675
Inventory end of month	2,748,482	—9.37	3,032,539	9,488,993
Truck and Bus Casings				
Shipments				
Original equipment	442,705		443,456	345,982
Replacement	749,986		803,917	512,761
Export	61,786		62,399	66,950
TOTAL	1,254,477	—4.22	1,309,772	925,693
Production	1,330,639	+13.23	1,175,150	1,116,701
Inventory end of month	803,384	+8.98	737,190	1,877,315
Total Automotive Casings				
Shipments				
Original equipment	3,035,246		3,244,576	3,093,753
Replacement	3,811,904		4,198,563	2,703,412
Export	114,340		129,691	115,830
TOTAL	6,961,490	—8.07	7,572,830	5,912,995
Production	6,763,948	—0.69	6,811,130	6,827,376
Inventory end of month	3,551,866	—5.78	3,769,729	11,366,308
Passenger and Truck and Bus Tubes				
Shipments				
Original equipment	3,038,670		3,247,154	3,089,546
Replacement	3,487,053		3,088,811	2,164,212
Export	69,356		87,022	58,270
TOTAL	6,595,079	+2.68	6,422,987	5,312,028
Production	5,950,266	—2.64	6,111,421	5,629,229
Inventory end of month	5,852,488	—11.44	6,608,314	10,925,678

SOURCE: The Rubber Manufacturers Association, Inc., New York, N. Y.

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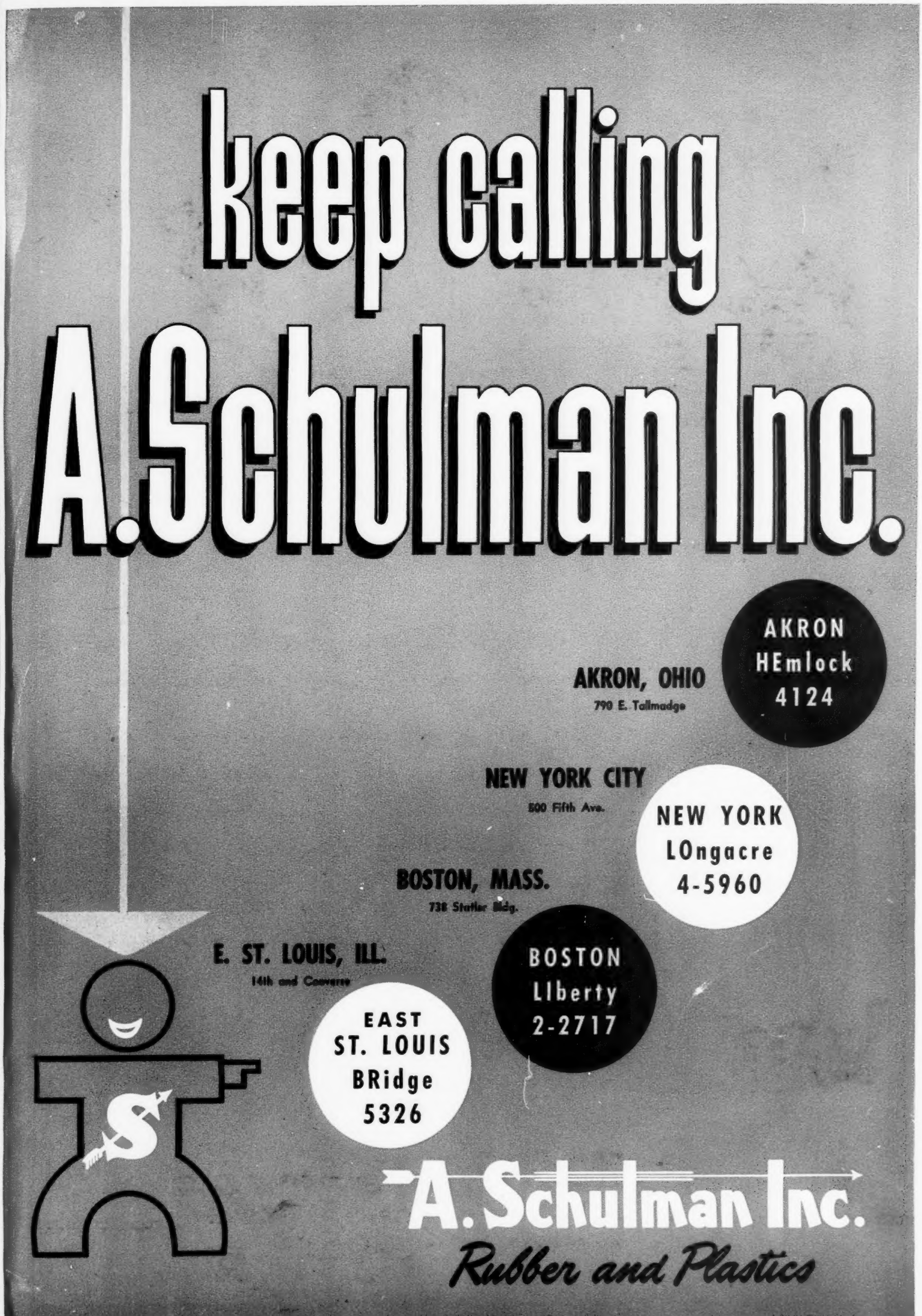
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